Figure 1: construction of a synthetic human antibody library based on consensus sequences

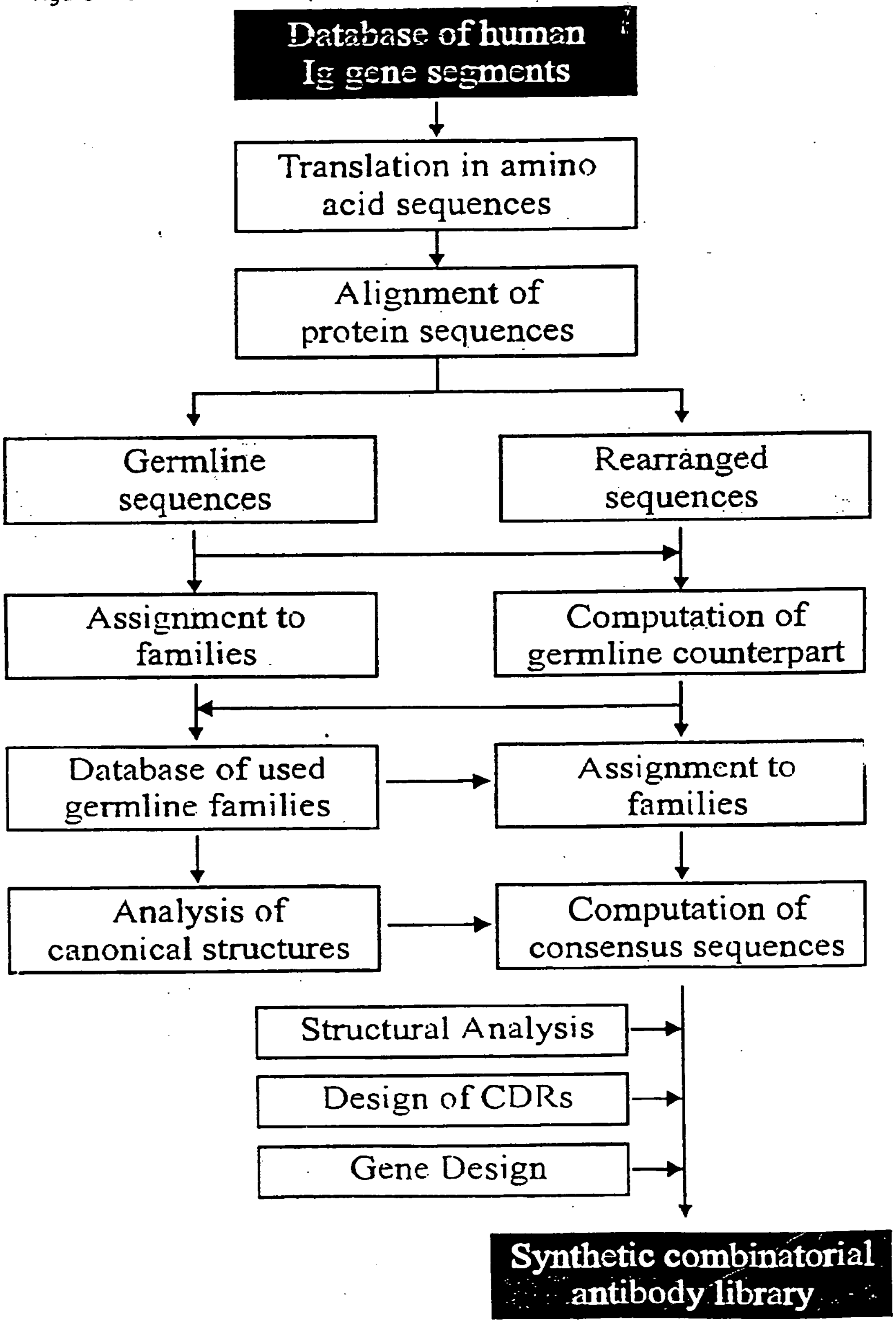

Figure 2A: VL kappa consensus sequences

| | framework 1 | | | | | | | | | | | | | | | | | | | | | | | CDRI | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | A | B | C |
| Vκ1 | D | I | Q | M | T | Q | S | P | S | S | L | S | A | S | V | G | D | R | V | T | I | T | C | R | A | S | Q | - | - | - |
| Vκ2 | D | I | V | M | T | Q | S | P | L | S | L | P | V | T | P | G | E | P | A | S | I | S | C | R | S | S | Q | S | L | L |
| Vκ3 | D | I | V | L | T | Q | S | P | A | T | L | S | L | S | P | G | E | R | A | T | L | S | C | R | A | S | Q | S | - | - |
| Vκ4 | D | I | V | M | T | Q | S | P | D | S | L | A | V | S | L | G | E | R | A | T | I | N | C | R | S | S | Q | S | V | L |

| | CDRI | | | | | | | | | | framework 2 | | | | | | | | | | | | | | | CDR II | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D | E | F | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 |
| Vκ1 | - | - | - | G | I | S | S | Y | L | A | W | Y | Q | Q | K | P | G | K | A | P | K | L | L | I | Y | A | A | S | S | L |
| Vκ2 | H | S | - | N | G | Y | N | Y | L | D | W | [illegible] | L | Q | K | P | G | Q | S | P | Q | L | L | I | Y | L | G | S | N | R |
| Vκ3 | - | - | - | V | S | S | S | Y | L | A | W | Y | Q | Q | K | P | G | Q | A | P | R | L | L | I | Y | G | A | S | S | R |
| Vκ4 | Y | S | S | N | N | K | N | Y | L | A | W | Y | Q | Q | K | P | G | Q | P | P | K | L | L | I | Y | W | A | S | T | R |

Figure 2A: VL kappa consensus sequences

| | CDRII | | framework 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 |
| Vκ1 | Q | S | G | V | P | S | R | F | S | G | S | G | S | G | T | D | F | T | L | T | I | S | S | L | Q | P | E | D | F | A |
| Vκ2 | A | S | G | V | P | D | R | F | S | G | S | G | S | G | T | D | F | T | L | K | I | S | R | V | E | A | E | D | V | G |
| Vκ3 | A | T | G | V | P | A | R | F | S | G | S | G | S | G | T | D | F | T | L | T | I | S | S | L | E | P | E | D | F | A |
| Vκ4 | E | S | G | V | P | D | R | F | S | G | S | G | S | G | T | D | F | T | L | T | I | S | S | L | Q | A | E | D | V | A |

| | framework 3 | | | | CDRIII | | | | | | | | framework 4 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 |
| Vκ1 | T | Y | Y | C | Q | Q | H | Y | T | T | P | P | T | F | G | Q | G | T | K | V | E | I | K | R | T |
| Vκ2 | V | Y | Y | C | Q | Q | H | Y | T | T | P | P | T | F | G | Q | G | T | K | V | E | I | K | R | T |
| Vκ3 | V | Y | Y | C | Q | Q | H | Y | T | T | P | P | T | F | G | Q | G | T | K | V | E | I | K | R | T |
| Vκ4 | V | Y | Y | C | Q | Q | H | Y | T | T | P | P | T | F | G | Q | G | T | K | V | E | I | K | R | T |

Figure 2B: VL lambda consensus sequences

| | framework 1 | | | | | | | | | | | | | | | | | | | | | | | CDRI | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | D | E | 28 |
| Vλ1 | Q | S | V | L | T | Q | P | P | S | - | V | S | G | A | P | G | Q | R | V | T | I | S | C | S | G | S | S | S | N | I |
| Vλ2 | Q | S | A | L | T | Q | P | A | S | - | V | S | G | S | P | G | Q | S | I | T | I | S | C | T | G | T | S | S | D | V |
| Vλ3 | S | Y | E | L | T | Q | P | P | S | - | V | S | V | A | P | G | Q | T | A | R | I | S | C | S | G | D | A | - | - | L |

| | CDRI | | | | | | | framework 2 | | | | | | | | | | | | | | | CDR II | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 29 | 30 | 31 | A | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 |
| Vλ1 | G | S | N | - | Y | V | S | W | Y | Q | Q | L | P | G | T | A | P | K | L | L | I | Y | D | N | N | Q | R | P | S | G |
| Vλ2 | G | G | Y | N | Y | V | S | W | Y | Q | Q | H | P | G | K | A | P | K | L | M | I | Y | D | V | S | N | R | P | S | G |
| Vλ3 | G | D | K | - | Y | A | S | W | Y | Q | Q | K | P | G | Q | A | P | V | L | V | I | Y | D | D | S | D | R | P | S | G |

09490064.012400

Figure 2B: VL lambda consensus sequences

| | framework 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 |
| Vλ1 | V | P | D | R | F | S | G | S | K | S | G | T | S | A | S | L | A | I | T | G | L | Q | S | E | D | E | A | D | Y | Y |
| Vλ2 | V | S | N | R | F | S | G | S | K | S | G | T | T | A | S | L | T | I | S | G | L | Q | A | E | D | E | A | D | Y | Y |
| Vλ3 | I | P | E | R | F | S | G | S | N | S | G | N | T | A | T | L | T | I | S | G | T | Q | A | E | D | E | A | D | Y | Y |

| | | CDRIII | | | | | | | | framework 4 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | A | 107 |
| Vλ1 | C | Q | Q | H | Y | T | T | P | P | V | F | G | G | G | T | K | L | T | V | L | G |
| Vλ2 | C | Q | Q | H | Y | T | T | P | P | V | F | G | G | G | T | K | L | T | V | L | G |
| Vλ3 | C | Q | Q | H | Y | T | T | P | P | V | F | G | G | G | T | K | L | T | V | L | G |

Figure 2C: V heavy chain consensus sequences

| | framework 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| VH1A | Q | V | Q | L | V | Q | S | G | A | E | V | K | K | P | G | S | S | V | K | V | S | C | K | A | S | G | G | T | F | S |
| VH1B | Q | V | Q | L | V | Q | S | G | A | E | V | [illegible] | K | P | G | A | S | V | K | V | S | C | K | A | S | G | Y | T | F | T |
| VH2 | Q | V | Q | L | K | E | S | G | P | A | L | V | K | P | T | Q | T | L | T | L | T | C | T | F | S | G | F | S | L | S |
| VH3 | E | V | Q | L | V | E | S | G | G | G | L | V | Q | P | G | G | S | L | R | L | S | C | A | A | S | G | F | T | F | S |
| VH4 | Q | V | Q | L | Q | E | S | G | P | G | L | V | K | P | S | E | T | L | S | L | T | C | T | V | S | G | G | S | I | S |
| VH5 | E | V | Q | L | V | Q | S | G | A | E | V | K | K | P | G | E | S | L | K | I | S | C | K | G | S | G | Y | S | F | T |
| VH6 | Q | V | Q | L | Q | Q | S | G | P | G | L | V | K | P | S | Q | T | L | S | L | T | C | A | I | S | G | D | S | V | S |

| | CDRI | | | | | | | | framework 2 | | | | | | | | | | | | | | CDR II | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 31 | A | B | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | A | B | C | 53 | 54 | 55 | 56 | 57 |
| VH1A | S | - | - | Y | A | I | S | W | V | R | Q | A | P | G | Q | G | L | E | W | M | G | G | I | I | P | - | - | I | F | G | T | A |
| VH1B | S | - | - | Y | Y | M | H | W | V | R | Q | A | P | G | Q | G | L | E | W | M | G | W | I | N | P | - | - | N | S | G | G | T |
| VH2 | T | S | G | V | G | V | G | W | I | R | Q | P | P | G | K | A | L | E | W | L | A | L | I | D | - | - | - | W | D | D | D | K |
| VH3 | S | - | - | Y | A | M | S | W | V | R | Q | A | P | G | K | G | L | E | W | V | S | A | I | S | G | - | - | S | G | G | S | T |
| VH4 | S | - | - | Y | Y | W | S | W | I | R | Q | P | P | G | K | G | L | E | W | I | G | Y | I | Y | - | - | - | Y | S | G | S | T |
| VH5 | S | - | - | Y | W | I | G | W | V | R | Q | M | P | G | K | G | L | E | W | M | G | I | I | Y | P | - | - | G | D | S | D | T |
| VH6 | S | N | S | A | A | W | N | W | I | R | Q | S | P | G | R | G | L | E | W | L | G | R | T | Y | Y | R | - | S | K | W | Y | N |

Figure 2C: V heavy chain consensus sequences

| | CDRII | | | | | | | | | | framework 3 | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | A | B | C | 83 | 84 | 85 |
| VH1A | N | Y | A | Q | K | F | Q | G | R | V | T | I | T | A | D | E | S | T | S | T | A | Y | M | E | L | S | S | L | R | S | E |
| VH1B | N | Y | A | Q | K | F | Q | G | R | V | T | M | T | R | D | T | S | I | S | T | A | Y | M | E | L | S | S | L | R | S | E |
| VH2 | Y | Y | S | T | S | L | K | T | R | L | T | I | S | K | D | T | S | K | N | Q | V | V | L | T | M | T | N | M | D | P | V |
| VH3 | Y | Y | A | D | S | V | K | G | R | F | T | I | S | R | D | N | S | K | N | T | L | Y | L | Q | M | N | S | L | R | A | E |
| VH4 | N | Y | N | P | S | L | K | S | R | V | T | I | S | V | D | T | S | K | N | Q | F | S | L | K | L | S | S | V | T | A | A |
| VH5 | R | Y | S | P | S | F | Q | G | Q | V | T | I | S | A | D | K | S | I | S | T | A | Y | L | Q | W | S | S | L | K | A | S |
| VH6 | D | Y | A | V | S | V | K | S | R | I | T | I | N | P | D | T | S | K | N | Q | F | S | L | Q | L | N | S | V | T | P | E |

| | framework 3 | | | | | | | | | | CDRIII | | | | | | | | | | | | | framework 4 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | A | B | C | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 |
| VH1A | D | T | A | V | Y | Y | C | A | R | W | G | G | D | G | F | Y | A | M | D | Y | W | G | Q | G | T | L | V | T | V | S | S |
| VH1B | D | T | A | V | Y | Y | C | A | R | W | G | G | D | G | F | Y | A | M | D | Y | W | G | Q | G | T | L | V | T | V | S | S |
| VH2 | D | T | A | T | Y | Y | C | A | R | W | G | G | D | G | F | Y | A | M | D | Y | W | G | Q | G | T | L | V | T | V | S | S |
| VH3 | D | T | A | V | Y | Y | C | A | R | W | G | G | D | G | F | Y | A | M | D | Y | W | G | Q | G | T | L | V | T | V | S | S |
| VH4 | D | T | A | V | Y | Y | C | A | R | W | G | G | D | G | F | Y | A | M | D | Y | W | G | Q | G | T | L | V | T | V | S | S |
| VH5 | D | T | A | M | Y | Y | C | A | R | W | G | G | D | G | F | Y | A | M | D | Y | W | G | Q | G | T | L | V | T | V | S | S |
| VH6 | D | T | A | V | Y | Y | C | A | R | W | G | G | D | G | F | Y | A | M | D | Y | W | G | Q | G | T | L | V | T | V | S | S |

09006490.012400

Figure 3A: V kappa 1 (Vκ1) gene sequence

```
.D  I  Q  M   T  Q  S   P  S  S   L  S  A  S   V  G  D
 EcoRV            BanII
~~~~~~~          ~~~~~~~~
GATATCCAGA TGACCCAGAG CCCGTCTAGC CTGAGCGCGA GCGTGGGTGA
CTATAGGTCT ACTGGGTCTC GGGCAGATCG GACTCGCGCT CGCACCCACT

  R  V  T   I  T  C  R   A  S  Q   G  I  S   S  Y  L
                PstI
               ~~~~~~~~
TCGTGTGACC ATTACCTGCA GAGCGAGCCA GGGCATTAGC AGCTATCTGG
AGCACACTGG TAATGGACGT CTCGCTCGGT CCCGTAATCG TCGATAGACC

A  W  Y  Q   Q  K  P   G  K  A  P   K  L  L   I  Y  A
    KpnI         SexAI                AseI
   ~~~~~~~      ~~~~~~~~~            ~~~~~~~~
CGTGGTACCA GCAGAAACCA GGTAAAGCAC CGAAACTATT AATTTATGCA
GCACCATGGT CGTCTTTGGT CCATTTCGTG GCTTTGATAA TTAAATACGT

 A  S  S  L   Q  S  G   V  P  S   R  F  S  G   S  G  S
                      SanDI                      BamHI
                     ~~~~~~~~~                   ~~~~~
GCCAGCAGCT TGCAAAGCGG GGTCCCGTCC CGTTTTAGCG GCTCTGGATC
```

Figure 3A: V kappa 1 (Vκ1) gene sequence (continued)

```
CGGTCGTCGA ACGTTTCGCC CCAGGGCAGG GCAAAATCGC CGAGACCTAG

  G  T  D   F  T  L  T   I  S  S   L  Q  P   E  D  F
                                        Eco57I
                                        ~~~~~~~~
BamHI                                        BbsI
~                                            ~~~~~~~
CGGCACTGAT TTTACCCTGA CCATTAGCAG CCTGCAACCT GAAGACTTTG
GCCGTGACTA AAATGGGACT GGTAATCGTC GGACGTTGGA CTTCTGAAAC

A  T  Y  Y   C  Q  Q   H  Y  T  T   P  P  T   F  G  Q
                                                MscI
                                               ~~~~~~~
CGACCTATTA TTGCCAGCAG CATTATACCA CCCCGCCGAC CTTTGGCCAG
GCTGGATAAT AACGGTCGTC GTAATATGGT GGGGCGGCTG GAAACCGGTC

 G  T  K  V   E  I  K   R  T
                        BsiWI
                       ~~~~~
GGTACGAAAG TTGAAATTAA ACGTACG
CCATGCTTTC AACTTTAATT TGCATGC
```

Figure 3B: V kappa 2 (Vκ2) gene sequence

```
 D  I  V  M   T  Q  S   P  L  S   L  P  V  T   P  G  E
 EcoRV              BanII
~~~~~~            ~~~~~~~~
GATATCGTGA TGACCCAGAG CCCACTGAGC CTGCCAGTGA CTCCGGGCGA
CTATAGCACT ACTGGGTCTC GGGTGACTCG GACGGTCACT GAGGCCCGCT

  P  A  S  I  S  C  R   S  S  Q   S  L  L   H  S  N
                PstI
              ~~~~~~~~
GCCTGCGAGC ATTAGCTGCA GAAGCAGCCA AAGCCTGCTG CATAGCAACG
CGGACGCTCG TAATCGACGT CTTCGTCGGT TTCGGACGAC GTATCGTTGC

G  Y  N  Y   L  D  W   Y  L  Q  K   P  G  Q   S  P  Q
                  KpnI            SexAI
                ~~~~~~~~        ~~~~~~~~
GCTATAACTA TCTGGATTGG TACCTTCAAA AACCAGGTCA AAGCCCGCAG
CGATATTGAT AGACCTAACC ATGGAAGTTT TTGGTCCAGT TTCGGGCGTC

 L  L  I  Y   L  G  S   N  R  A   S  G  V  P   D  R  F
  AseI                                SanDI
 ~~~~~~                             ~~~~~~~~~
CTATTAATTT ATCTGGGCAG CAACCGTGCC AGTGGGGTCC CGGATCGTTT
GATAATTAAA TAGACCCGTC GTTGGCACGG TCACCCCAGG GCCTAGCAAA
```

00h2T0' h9006h60

Figure 3B: V kappa 2 (Vκ2) gene sequence (continued)

```
 S  G  S   G  S  G  T   D  F  T   L  K  I   S  R  V
           BamHI
          ~~~~~~~
TAGCGGCTCT GGATCCGGCA CCGATTTTAC CCTGAAAATT AGCCGTGTGG
ATCGCCGAGA CCTAGGCCGT GGCTAAAATG GGACTTTTAA TCGGCACACC

E  A  E  D   V  G  V   Y  Y  C  Q   Q  H  Y   T  T  P
   Eco57I
   ~~~~~~~
      BbsI
     ~~~~~~~~
AAGCTGAAGA CGTGGGCGTG TATTATTGCC AGCAGCATTA TACCACCCCG
TTCGACTTCT GCACCCGCAC ATAATAACGG TCGTCGTAAT ATGGTGGGGC

 P  T  F  G   Q  G  T   K  V  E   I  K  R  T
        MscI                            BsiWI
      ~~~~~~~~                         ~~~~~~~
CCGACCTTTG GCCAGGGTAC GAAAGTTGAA ATTAAACGTA CG
GGCTGGAAAC CGGTCCCATG CTTTCAACTT TAATTTGCAT GC
```

Figure 3C: V kappa 3 (Vκ3) gene sequence

```
 D  I  V  L  T  Q  S  P  A  T  L  S  L  S  P  G  E
 EcoRV            BanII
~~~~~~           ~~~~~~~~
GATATCGTGC TGACCCAGAG CCCGGCGACC CTGAGCCTGT CTCCGGGCGA
CTATAGCACG ACTGGGTCTC GGGCCGCTGG GACTCGGACA GAGGCCCGCT

  R  A  T  L  S  C  R  A  S  Q  S  V  S  S  S  Y
               PstI
              ~~~~~~~~
ACGTGCGACC CTGAGCTGCA GAGCGAGCCA GAGCGTGAGC AGCAGCTATC
TGCACGCTGG GACTCGACGT CTCGCTCGGT CTCGCACTCG TCGTCGATAG

L  A  W  Y  Q  Q  K  P  G  Q  A  P  R  L  L  I  Y
      KpnI           SexAI                   AseI
     ~~~~~~~~       ~~~~~~~~~               ~~~~~~~
TGGCGTGGTA CCAGCAGAAA CCAGGTCAAG CACCGCGTCT ATTAATTTAT
ACCGCACCAT GGTCGTCTTT GGTCCAGTTC GTGGCGCAGA TAATTAAATA

 G  A  S  S  R  A  T  G  V  P  A  R  F  S  G  S  G
                         SanDI                  BamHI
                        ~~~~~~~~                   ~~
GGCGCGAGCA GCCGTGCAAC TGGGGTCCCG GCGCGTTTTA GCGGCTCTGG
```

Figure 3C: V kappa 3 (Vκ3) gene sequence (continued)

```
CCGCGCTCGT CGGCACGTTG ACCCCAGGGC CGCGCAAAAT CGCCGAGACC

 S  G  T   D  F  T  L   T  I  S   S  L  E   P  E  D
                                            Eco57I
                                            ~~~~~~~
                                                BbsI
BamHI                                          ~~~~~~~
~~~~
ATCCGGCACG GATTTTACCC TGACCATTAG CAGCCTGGAA CCTGAAGACT
TAGGCCGTGC CTAAAATGGG ACTGGTAATC GTCGGACCTT GGACTTCTGA

F  A  V  Y   Y  C  Q   Q  H  Y  T   T  P  P   T  F  G
                                                 MscI
                                                 ~~~~
TTGCGGTGTA TTATTGCCAG CAGCATTATA CCACCCCGCC GACCTTTGGC
AACGCCACAT AATAACGGTC GTCGTAATAT GGTGGGGCGG CTGGAAACCG

 Q  G  T  K   V  E  I   K  R  T
MscI                       BsiWI
~~                       ~~~~~~
CAGGGTACGA AAGTTGAAAT TAAACGTACG
GTCCCATGCT TTCAACTTTA ATTTGCATGC
```

Figure 3D: V kappa 4 (Vκ4) gene sequence

```
D  I  V  M   T  Q  S   P  D  S   L  A  V  S   L  G  E
EcoRV             BanII
~~~~~~           ~~~~~~~~
GATATCGTGA TGACCCAGAG CCCGGATAGC CTGGCGGTGA GCCTGGGCGA
CTATAGCACT ACTGGGTCTC GGGCCTATCG GACCGCCACT CGGACCCGCT

 R  A  T   I  N  C  R   S  S  Q   S  V  L   Y  S  S
                PstI
               ~~~~~~~~
ACGTGCGACC ATTAACTGCA GAAGCAGCCA GAGCGTGCTG TATAGCAGCA
TGCACGCTGG TAATTGACGT CTTCGTCGGT CTCGCACGAC ATATCGTCGT

N  N  K  N   Y  L  A   W  Y  Q  Q   K  P  G   Q  P  P
                        KpnI         SexAI
                       ~~~~~~       ~~~~~~~~~
ACAACAAAAA CTATCTGGCG TGGTACCAGC AGAAACCAGG TCAGCCGCCG
TGTTGTTTTT GATAGACCGC ACCATGGTCG TCTTTGGTCC AGTCGGCGGC

 K  L  L  I   Y  W  A   S  T  R   E  S  G  V   P  D  R
     AseI                                 SanDI
    ~~~~~~~~                             ~~~~~~~~~
AAACTATTAA TTTATTGGGC ATCCACCCGT GAAAGCGGGG TCCCGGATCG
TTTGATAATT AAATAACCCG TAGGTGGGCA CTTTCGCCCC AGGGCCTAGC
```

Figure 3D: V kappa 4 (Vκ4) gene sequence (continued)

```
 F  S  G   S  G  S  G   T  D  F   T  L  T   I  S  S
                BamHI
               ~~~~~~~
TTTTAGCGGC TCTGGATCCG GCACTGATTT TACCCTGACC ATTTCGTCCC
AAAATCGCCG AGACCTAGGC CGTGACTAAA ATGGGACTGG TAAAGCAGGG

L  Q  A  E   D  V  A   V  Y  Y  C   Q  Q  H   Y  T  T
      Eco57I
      ~~~~~~~~
        BbsI
       ~~~~~~~~
TGCAAGCTGA AGACGTGGCG GTGTATTATT GCCAGCAGCA TTATACCACC
ACGTTCGACT TCTGCACCGC CACATAATAA CGGTCGTCGT AATATGGTGG

 P  P  T  F   G  Q  G   T  K  V   E  I  K  R   T
             MscI                            BsiWI
            ~~~~~~                          ~~~~~~
CCGCCGACCT TTGGCCAGGG TACGAAAGTT GAAATTAAAC GTACG
GGCGGCTGGA AACCGGTCCC ATGCTTTCAA CTTTAATTTG CATGC
```

00h2T0" h9006h60

Figure 4A: V lambda 1 (Vλ1) gene sequence

```
Q  S  V  L  T  Q  P  P  S  V  S  G  A  P  G  Q  R
                                       SexAI
                                     ~~~~~~~~~
CAGAGCGTGC TGACCCAGCC GCCTTCAGTG AGTGGCGCAC CAGGTCAGCG
GTCTCGCACG ACTGGGTCGG CGGAAGTCAC TCACCGCGTG GTCCAGTCGC
                        Eco57I
                        ~~~~~~

V  T  I  S  C  S  G  S  S  S  N  I  G  S  N  Y
         BssSI
       ~~~~~~~~
TGTGACCATC TCGTGTAGCG GCAGCAGCAG CAACATTGGC AGCAACTATG
ACACTGGTAG AGCACATCGC CGTCGTCGTC GTTGTAACCG TCGTTGATAC

V  S  W  Y  Q  Q  L  P  G  T  A  P  K  L  L  I  Y
      KpnI            XmaI    BbeI
    ~~~~~~~~        ~~~~~~  ~~~~~~~~
TGAGCTGGTA CCAGCAGTTG CCCGGGACGG CGCCGAAACT GCTGATTTAT
ACTCGACCAT GGTCGTCAAC GGGCCCTGCC GCGGCTTTGA CGACTAAATA

D  N  N  Q  R  P  S  G  V  P  D  R  F  S  G  S  K
             Bsu36I                         BamHI

            ~~~~~~~~~                     ~~~~~~
```

09900574.021400

Figure 4A: V lambda 1 (Vλ1) gene sequence (continued)

```
GATAACAACC  AGCGTCCCTC  AGGCGTGCCG  GATCGTTTTA  GCGGATCCAA
CTATTGTTGG  TCGCAGGGAG  TCCGCACGGC  CTAGCAAAAT  CGCCTAGGTT

  S  G  T   S  A  S  L   A  I  T   G  L  Q   S  E  D
                                                 BbsI
                                                ~~~~~~
AAGCGGCACC  AGCGCGAGCC  TTGCGATTAC  GGGCCTGCAA  AGCGAAGACG
TTCGCCGTGG  TCGCGCTCGG  AACGCTAATG  CCCGGACGTT  TCGCTTCTGC

E  A  D  Y   Y  C  Q   Q  H  Y  T   T  P  P   V  F  G
AAGCGGATTA  TTATTGCCAG  CAGCATTATA  CCACCCCGCC  TGTGTTTGGC
TTCGCCTAAT  AATAACGGTC  GTCGTAATAT  GGTGGGGCGG  ACACAAACCG

 G  G  T  K   L  T  V   L  G
             HpaI       MscI
            ~~~~~~      ~~~
GGCGGCACGA  AGTTAACCGT  TCTTGGC
CCGCCGTGCT  TCAATTGGCA  AGAACCG
```

Figure 4B: V lambda 2 (Vλ2) gene sequence

```
  Q  S  A  L   T  Q  P   A  S  V   S  G  S  P   G  Q  S
                                                SexAI
                                               ~~~~~~~~~
CAGAGCGCAC TGACCCAGCC AGCTTCAGTG AGCGGCTCAC CAGGTCAGAG
GTCTCGCGTG ACTGGGTCGG TCGAAGTCAC TCGCCGAGTG GTCCAGTCTC
                         Eco57I
                         ~~~~~~

   I  T  I   S  C  T  G   T  S  S   D  V  G   G  Y  N
          BssSI
         ~~~~~~~~
CATTACCATC TCGTGTACGG GTACTAGCAG CGATGTGGGC GGCTATAACT
GTAATGGTAG AGCACATGCC CATGATCGTC GCTACACCCG CCGATATTGA

 Y  V  S  W   Y  Q  Q   H  P  G  K   A  P  K   L  M  I
          KpnI           XmaI      BbeI
         ~~~~~~~~       ~~~~~~~   ~~~~~~~
ATGTGAGCTG GTACCAGCAG CATCCCGGGA AGGCGCCGAA ACTGATGATT
TACACTCGAC CATGGTCGTC GTAGGGCCCT TCCGCGGCTT TGACTACTAA

  Y  D  V  S   N  R  P   S  G  V   S  N  R  F   S  G  S
                    Bsu36I                           BamHI
                   ~~~~~~~~~                         ~~~~~
TATGATGTGA GCAACCGTCC CTCAGGCGTG AGCAACCGTT TTAGCGGATC
ATACTACACT CGTTGGCAGG GAGTCCGCAC TCGTTGGCAA AATCGCCTAG
```

Figure 4B: V lambda 2 (Vλ2) gene sequence (continued)

```
  K  S  G   N  T  A  S   L  T  I   S  G  L   Q  A  E
BamHI                                              BbsI
~                                                  ~~~~
CAAAAGCGGC AACACCGCGA GCCTGACCAT TAGCGGCCTG CAAGCGGAAG
GTTTTCGCCG TTGTGGCGCT CGGACTGGTA ATCGCCGGAC GTTCGCCTTC

D  E  A  D  Y  Y  C   Q  Q  H  Y   T  T  P   P  V  F
BbsI
~~
ACGAAGCGGA TTATTATTGC CAGCAGCATT ATACCACCCC GCCTGTGTTT
TGCTTCGCCT AATAATAACG GTCGTCGTAA TATGGTGGGG CGGACACAAA

 G  G  G  T   K  L  T   V  L  G
              HpaI       MscI
             ~~~~~~      ~~~~
GGCGGCGGCA CGAAGTTAAC CGTTCTTGGC
CCGCCGCCGT GCTTCAATTG GCAAGAACCG
```

Figure 4C: V lambda 3 (Vλ3) gene sequence

```
 S  Y  E  L   T  Q  P   P  S  V   S  V  A  P   G  Q  T
                                          SexAI
                                         ~~~~~~~~~
AGCTATGAAC TGACCCAGCC GCCTTCAGTG AGCGTTGCAC CAGGTCAGAC
TCGATACTTG ACTGGGTCGG CGGAAGTCAC TCGCAACGTG GTCCAGTCTG
                        Eco57I
                        ~~~~~~

  A  R  I   S  C  S  G   D  A  L   G  D  K   Y  A  S
           BssSI
          ~~~~~~~~
CGCGCGTATC TCGTGTAGCG GCGATGCGCT GGGCGATAAA TACGCGAGCT
GCGCGCATAG AGCACATCGC CGCTACGCGA CCCGCTATTT ATGCGCTCGA

W  Y  Q  Q   K  P  G   Q  A  P  V   L  V  I   Y  D  D
 KpnI           XmaI     BbeI
~~~~~~          ~~~~~~   ~~~~~~
GGTACCAGCA GAAACCCGGG CAGGCGCCAG TTCTGGTGAT TTATGATGAT
CCATGGTCGT CTTTGGGCCC GTCCGCGGTC AAGACCACTA AATACTACTA
```

00429010.042400

Figure 4C: V lambda 3 (Vλ3) gene sequence (continued)

```
 S  D  R  P   S  G  I   P  E  R   F  S  G  S   N  S  G
              Bsu36I                       BamHI
              ~~~~~~~~                    ~~~~~~~~
TCTGACCGTC CCTCAGGCAT CCCGGAACGC TTTAGCGGAT CCAACAGCGG
AGACTGGCAG GGAGTCCGTA GGGCCTTGCG AAATCGCCTA GGTTGTCGCC

 N  T  A   T  L  T  I   S  G  T   Q  A  E   D  E  A
                                       BbsI
                                      ~~~~~~~~
CAACACCGCG ACCCTGACCA TTAGCGGCAC TCAGGCGGAA GACGAAGCGG
GTTGTGGCGC TGGGACTGGT AATCGCCGTG AGTCCGCCTT CTGCTTCGCC

D  Y  Y  C   Q  Q  H   Y  T  T  P   P  V  F   G  G  G
ATTATTATTG CCAGCAGCAT TATACCACCC CGCCTGTGTT TGGCGGCGGC
TAATAATAAC GGTCGTCGTA ATATGGTGGG GCGGACACAA ACCGCCGCCG

 T  K  L  T   V  L  G
      HpaI        MscI
     ~~~~~~~~     ~~~~
ACGAAGTTAA CCGTTCTTGG C
TGCTTCAATT GGCAAGAACC G
```

Figure 5A: V heavy chain 1A (VH1A) gene sequence

```
  Q  V  Q  L   V  Q  S   G  A  E   V  K  K  P   G  S  S
        MfeI
      ~~~~~~~~
CAGGTGCAAT TGGTTCAGTC TGGCGCGGAA GTGAAAAAAC CGGGCAGCAG
GTCCACGTTA ACCAAGTCAG ACCGCGCCTT CACTTTTTTG GCCCGTCGTC

  V  K  V   S  C  K  A   S  G  G   T  F  S   S  Y  A
                          BspEI
                         ~~~~~~
CGTGAAAGTG AGCTGCAAAG CCTCCGGAGG CACTTTTAGC AGCTATGCGA
GCACTTTCAC TCGACGTTTC GGAGGCCTCC GTGAAAATCG TCGATACGCT

I  S  W  V   R  Q  A   P  G  Q  G   L  E  W   M  G  G
                BstXI              XhoI
         ~~~~~~~~~~~~~~         ~~~~~~
TTAGCTGGGT GCGCCAAGCC CCTGGGCAGG GTCTCGAGTG GATGGGCGGC
AATCGACCCA CGCGGTTCGG GGACCCGTCC CAGAGCTCAC CTACCCGCCG

 I  I  P  I   F  G  T   A  N  Y   A  Q  K  F   Q  G  R
ATTATTCCGA TTTTTGGCAC GGCGAACTAC GCGCAGAAGT TTCAGGGCCG
TAATAAGGCT AAAAACCGTG CCGCTTGATG CGCGTCTTCA AAGTCCCGGC

  V  T  I   T  A  D  E   S  T  S   T  A  Y   M  E  L
BstEII
```

Figure 5A: V heavy chain 1A (VH1A) gene sequence (continued)

```
~~~~~~~~
GGTGACCATT ACCGCGGATG AAAGCACCAG CACCGCGTAT ATGGAACTGA
CCACTGGTAA TGGCGCCTAC TTTCGTGGTC GTGGCGCATA TACCTTGACT

 S  S  L  R   S  E  D   T  A  V  Y   Y  C  A   R  W  G
                          EagI           BssHII
                        ~~~~~~~         ~~~~~~~~
GCAGCCTGCG TAGCGAAGAT ACGGCCGTGT ATTATTGCGC GCGTTGGGGC
CGTCGGACGC ATCGCTTCTA TGCCGGCACA TAATAACGCG CGCAACCCCG

  G  D  G  F   Y  A  M   D  Y  W   G  Q  G  T   L  V  T
                                      StyI
                                     ~~~~~~
GGCGATGGCT TTTATGCGAT GGATTATTGG GGCCAAGGCA CCCTGGTGAC
CCGCTACCGA AAATACGCTA CCTAATAACC CCGGTTCCGT GGGACCACTG

  V  S  S
     BlpI
    ~~~~~~
GGTTAGCTCA G
CCAATCGAGT C
```

Figure 5B: V heavy chain 1B (VH1B) gene sequence

```
 Q  V  Q  L   V  Q  S   G  A  E   V  K  K  P   G  A  S
      MfeI
     ~~~~~~~~
CAGGTGCAAT TGGTTCAGAG CGGCGCGGAA GTGAAAAAAC CGGGCGCGAG
GTCCACGTTA ACCAAGTCTC GCCGCGCCTT CACTTTTTTG GCCCGCGCTC

  V  K  V   S  C  K  A   S  G  Y   T  F  T   S  Y  Y
                          BspEI
                         ~~~~~~~
CGTGAAAGTG AGCTGCAAAG CCTCCGGATA TACCTTTACC AGCTATTATA
GCACTTTCAC TCGACGTTTC GGAGGCCTAT ATGGAAATGG TCGATAATAT

M  H  W  V   R  Q  A   P  G  Q  G   L  E  W   M  G  W
                  BstXI              XhoI
              ~~~~~~~~~~~~~~        ~~~~~~
TGCACTGGGT CCGCCAAGCC CCTGGGCAGG GTCTCGAGTG GATGGGCTGG
ACGTGACCCA GGCGGTTCGG GGACCCGTCC CAGAGCTCAC CTACCCGACC

 I  N  P  N   S  G  G   T  N  Y   A  Q  K  F   Q  G  R
ATTAACCCGA ATAGCGGCGG CACGAACTAC GCGCAGAAGT TTCAGGGCCG
TAATTGGGCT TATCGCCGCC GTGCTTGATG CGCGTCTTCA AAGTCCCGGC
```

Figure 5B: V heavy chain 1B (VH1B) gene sequence (continued)

```
 V  T  M   T  R  D  T   S  I  S   T  A  Y   M  E  L
BstEII
~~~~~~~~
GGTGACCATG ACCCGTGATA CCAGCATTAG CACCGCGTAT ATGGAACTGA
CCACTGGTAC TGGGCACTAT GGTCGTAATC GTGGCGCATA TACCTTGACT

S  S  L  R   S  E  D   T  A  V  Y   Y  C  A   R  W  G
                        EagI            BssHII
                       ~~~~~~~          ~~~~~~~~
GCAGCCTGCG TAGCGAAGAT ACGGCCGTGT ATTATTGCGC GCGTTGGGGC
CGTCGGACGC ATCGCTTCTA TGCCGGCACA TAATAACGCG CGCAACCCCG

 G  D  G  F   Y  A  M   D  Y  W   G  Q  G  T   L  V  T
                                     StyI
                                   ~~~~~~~
GGCGATGGCT TTTATGCGAT GGATTATTGG GGCCAAGGCA CCCTGGTGAC
CCGCTACCGA AAATACGCTA CCTAATAACC CCGGTTCCGT GGGACCACTG

 V  S  S
    BlpI
   ~~~~~~
GGTTAGCTCA G
CCAATCGAGT C
```

Figure 5C: V heavy chain 2 (VH2) gene sequence

```
 Q  V  Q  L   K  E  S   G  P  A   L  V  K  P   T  Q  T
      MfeI
     ~~~~~~~~
CAGGTGCAAT TGAAAGAAAG CGGCCCGGCC CTGGTGAAAC CGACCCAAAC
GTCCACGTTA ACTTTCTTTC GCCGGGCCGG GACCACTTTG GCTGGGTTTG

  L  T  L   T  C  T  F   S  G  F   S  L  S   T  S  G
                         BspEI
                        ~~~~~~
CCTGACCCTG ACCTGTACCT TTTCCGGATT TAGCCTGTCC ACGTCTGGCG
GGACTGGGAC TGGACATGGA AAAGGCCTAA ATCGGACAGG TGCAGACCGC

V  G  V  G   W  I  R   Q  P  P  G   K  A  L   E  W  L
                         BstXI              XhoI
                     ~~~~~~~~~~~~~~~     ~~~~~~~~
TTGGCGTGGG CTGGATTCGC CAGCCGCCTG GGAAAGCCCT CGAGTGGCTG
AACCGCACCC GACCTAAGCG GTCGGCGGAC CCTTTCGGGA GCTCACCGAC

 A  L  I  D   W  D  D   D  K  Y   Y  S  T  S   L  K  T
                                                  MluI
                                                    ~~
GCTCTGATTG ATTGGGATGA TGATAAGTAT TATAGCACCA GCCTGAAAAC
CGAGACTAAC TAACCCTACT ACTATTCATA ATATCGTGGT CGGACTTTTG
```

Figure 5C: V heavy chain 2 (VH2) gene sequence (continued)

```
  R  L  T   I  S  K  D   T  S  K   N  Q  V   V  L  T
MluI                     NspV
~~~~                    ~~~~~~
GCGTCTGACC ATTAGCAAAG ATACTTCGAA AAATCAGGTG GTGCTGACTA
CGCAGACTGG TAATCGTTTC TATGAAGCTT TTTAGTCCAC CACGACTGAT

M  T  N  M   D  P  V   D  T  A  T   Y  Y  C   A  R  W
                                          BssHII
                                          ~~~~~~~
TGACCAACAT GGACCCGGTG GATACGGCCA CCTATTATTG CGCGCGTTGG
ACTGGTTGTA CCTGGGCCAC CTATGCCGGT GGATAATAAC GCGCGCAACC

 G  G  D  G   F  Y  A   M  D  Y   W  G  Q  G   T  L  V
                                     StyI
                                   ~~~~~~~
GGCGGCGATG GCTTTTATGC GATGGATTAT TGGGGCCAAG GCACCCTGGT
CCGCCGCTAC CGAAAATACG CTACCTAATA ACCCCGGTTC CGTGGGACCA

  T  V  S   S
        BlpI
       ~~~~~~
GACGGTTAGC TCAG
CTGCCAATCG AGTC
```

Figure 5D: V heavy chain 3 (VH3) gene sequence

```
 E   V   Q   L    V   E   S    G   G   G    L   V   Q   P    G   G   S
       MfeI
      ~~~~~~~~
GAAGTGCAAT TGGTGGAAAG CGGCGGCGGC CTGGTGCAAC CGGGCGGCAG
CTTCACGTTA ACCACCTTTC GCCGCCGCCG GACCACGTTG GCCCGCCGTC

  L   R   L    S   C   A   A    S   G   F    T   F   S    S   Y   A
                               BspEI
                              ~~~~~~~
CCTGCGTCTG AGCTGCGCGG CCTCCGGATT TACCTTTAGC AGCTATGCGA
GGACGCAGAC TCGACGCGCC GGAGGCCTAA ATGGAAATCG TCGATACGCT

M   S   W   V    R   Q   A    P   G   K   G    L   E   W    V   S   A
                      BstXI                    XhoI
                  ~~~~~~~~~~~~~~              ~~~~~~
TGAGCTGGGT GCGCCAAGCC CCTGGGAAGG GTCTCGAGTG GGTGAGCGCG
ACTCGACCCA CGCGGTTCGG GGACCCTTCC CAGAGCTCAC CCACTCGCGC

 I   S   G   S    G   G   S    T   Y   Y    A   D   S   V    K   G   R
ATTAGCGGTA GCGGCGGCAG CACCTATTAT GCGGATAGCG TGAAAGGCCG
TAATCGCCAT CGCCGCCGTC GTGGATAATA CGCCTATCGC ACTTTCCGGC
```

Figure 5D: V heavy chain 3 (VH3) gene sequence (continued)

```
  F  T  I   S  R  D  N   S  K  N  T  L  Y  L  Q  M
             PmlI          NspV
            ~~~~~~~       ~~~~~~~
TTTTACCATT TCACGTGATA ATTCGAAAAA CACCCTGTAT CTGCAAATGA
AAAATGGTAA AGTGCACTAT TAAGCTTTTT GTGGGACATA GACGTTTACT

N  S  L  R   A  E  D   T  A  V  Y   Y  C  A   R  W  G
                        EagI           BssHII
                       ~~~~~~~        ~~~~~~~~
ACAGCCTGCG TGCGGAAGAT ACGGCCGTGT ATTATTGCGC GCGTTGGGGC
TGTCGGACGC ACGCCTTCTA TGCCGGCACA TAATAACGCG CGCAACCCCG

 G  D  G  F   Y  A  M   D  Y  W   G  Q  G  T   L  V  T
                                     StyI
                                   ~~~~~~~
GGCGATGGCT TTTATGCGAT GGATTATTGG GGCCAAGGCA CCCTGGTGAC
CCGCTACCGA AAATACGCTA CCTAATAACC CCGGTTCCGT GGGACCACTG

  V  S  S
     BlpI
    ~~~~~~~
GGTTAGCTCA G
CCAATCGAGT C
```

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00420.49006460

Figure 5E: V heavy chain 4 (VH4) gene sequence

```
 Q  V  Q  L   Q  E  S   G  P  G   L  V  K  P   S  E  T
      MfeI
     ~~~~~~~~
CAGGTGCAAT TGCAAGAAAG TGGTCCGGGC CTGGTGAAAC CGAGCGAAAC
GTCCACGTTA ACGTTCTTTC ACCAGGCCCG GACCACTTTG GCTCGCTTTG

  L  S  L   T  C  T  V   S  G  G   S  I  S   S  Y  Y
                         BspEI
                        ~~~~~~~
CCTGAGCCTG ACCTGCACCG TTTCCGGAGG CAGCATTAGC AGCTATTATT
GGACTCGGAC TGGACGTGGC AAAGGCCTCC GTCGTAATCG TCGATAATAA

W  S  W  I   R  Q  P   P  G  K  G   L  E  W   I  G  Y
                 BstXI               XhoI
          ~~~~~~~~~~~~~~~          ~~~~~~~
GGAGCTGGAT TCGCCAGCCG CCTGGGAAGG GTCTCGAGTG GATTGGCTAT
CCTCGACCTA AGCGGTCGGC GGACCCTTCC CAGAGCTCAC CTAACCGATA

 I  Y  Y  S   G  S  T   N  Y  N   P  S  L  K   S  R  V
                                                 BstEII
                                                    ~~~
ATTTATTATA GCGGCAGCAC CAACTATAAT CCGAGCCTGA AAAGCCGGGT
TAAATAATAT CGCCGTCGTG GTTGATATTA GGCTCGGACT TTTCGGCCCA
```

00424014.090601

Figure 5E: V heavy chain 4 (VH4) gene sequence (continued)

```
  T  I  S   V  D  T  S   K  N  Q   F  S  L   K  L  S
BstEII                NspV
~~~~                 ~~~~~~~~
GACCATTAGC GTTGATACTT CGAAAAACCA GTTTAGCCTG AAACTGAGCA
CTGGTAATCG CAACTATGAA GCTTTTTGGT CAAATCGGAC TTTGACTCGT

S  V  T  A   A  D  T   A  V  Y  Y   C  A  R   W  G  G
                      EagI               BssHII
                     ~~~~~~~~            ~~~~~~~
GCGTGACGGC GGCGGATACG GCCGTGTATT ATTGCGCGCG TTGGGGCGGC
CGCACTGCCG CCGCCTATGC CGGCACATAA TAACGCGCGC AACCCCGCCG

 D  G  F  Y   A  M  D   Y  W  G   Q  G  T  L   V  T  V
                                  StyI
                                ~~~~~~~~
GATGGCTTTT ATGCGATGGA TTATTGGGGC CAAGGCACCC TGGTGACGGT
CTACCGAAAA TACGCTACCT AATAACCCCG GTTCCGTGGG ACCACTGCCA

  S  S
   BlpI
  ~~~~~~
TAGCTCAG
ATCGAGTC
```

00420.19006460

Figure 5F: V heavy chain 5 (VH5) gene sequence

```
 E  V  Q  L   V  Q  S   G  A  E   V  K  K  P   G  E  S
      MfeI
     ~~~~~~~~
GAAGTGCAAT TGGTTCAGAG CGGCGCGGAA GTGAAAAAAC CGGGCGAAAG
CTTCACGTTA ACCAAGTCTC GCCGCGCCTT CACTTTTTTG GCCCGCTTTC

  L  K  I   S  C  K  G   S  G  Y   S  F  T   S  Y  W
                        BspEI
                       ~~~~~~~
CCTGAAAATT AGCTGCAAAG GTTCCGGATA TTCCTTTACG AGCTATTGGA
GGACTTTTAA TCGACGTTTC CAAGGCCTAT AAGGAAATGC TCGATAACCT

I  G  W  V   R  Q  M   P  G  K  G   L  E  W   M  G  I
                 BstXI              XhoI
             ~~~~~~~~~~~~~~       ~~~~~~~
TTGGCTGGGT GCGCCAGATG CCTGGGAAGG GTCTCGAGTG GATGGGCATT
AACCGACCCA CGCGGTCTAC GGACCCTTCC CAGAGCTCAC CTACCCGTAA

  I  Y  P  G   D  S  D   T  R  Y   S  P  S  F   Q  G  Q
ATTTATCCGG GCGATAGCGA TACCCGTTAT TCTCCGAGCT TTCAGGGCCA
TAAATAGGCC CGCTATCGCT ATGGGCAATA AGAGGCTCGA AAGTCCCGGT
```

Figure 5F: V heavy chain 5 (VH5) gene sequence (continued)

```
  V  T  I  S  A  D  K  S  I  S  T  A  Y  L  Q  W
 BstEII
 ~~~~~~~~
 GGTGACCATT AGCGCGGATA AAAGCATTAG CACCGCGTAT CTTCAATGGA
 CCACTGGTAA TCGCGCCTAT TTTCGTAATC GTGGCGCATA GAAGTTACCT

 S  S  L  K  A  S  D  T  A  M  Y  Y  C  A  R  W  G
                                     BssHII
                                     ~~~~~~~~
 GCAGCCTGAA AGCGAGCGAT ACGGCCATGT ATTATTGCGC GCGTTGGGGC
 CGTCGGACTT TCGCTCGCTA TGCCGGTACA TAATAACGCG CGCAACCCCG

  G  D  G  F  Y  A  M  D  Y  W  G  Q  G  T  L  V  T
                                  StyI
                                  ~~~~~~
 GGCGATGGCT TTTATGCGAT GGATTATTGG GGCCAAGGCA CCCTGGTGAC
 CCGCTACCGA AAATACGCTA CCTAATAACC CCGGTTCCGT GGGACCACTG

  V  S  S
     BlpI
    ~~~~~~
 GGTTAGCTCA G
 CCAATCGAGT C
```

Figure 5G: V heavy chain 6 (VH6) gene sequence

```
 Q  V  Q  L   Q  Q  S   G  P  G   L  V  K  P   S  Q  T
       MfeI
      ~~~~~~~~
CAGGTGCAAT TGCAACAGTC TGGTCCGGGC CTGGTGAAAC CGAGCCAAAC
GTCCACGTTA ACGTTGTCAG ACCAGGCCCG GACCACTTTG GCTCGGTTTG

 L  S  L   T  C  A  I   S  G  D   S  V  S   S  N  S
                        BspEI
                       ~~~~~~
CCTGAGCCTG ACCTGTGCGA TTTCCGGAGA TAGCGTGAGC AGCAACAGCG
GGACTCGGAC TGGACACGCT AAAGGCCTCT ATCGCACTCG TCGTTGTCGC

A  A  W  N   W  I  R   Q  S  P  G   R  G  L   E  W  L
                        BstXI          XhoI
                 ~~~~~~~~~~~~~~~     ~~~~~~~~
CGGCGTGGAA CTGGATTCGC CAGTCTCCTG GGCGTGGCCT CGAGTGGCTG
GCCGCACCTT GACCTAAGCG GTCAGAGGAC CCGCACCGGA GCTCACCGAC

 G  R  T  Y   Y  R  S   K  W  Y   N  D  Y  A   V  S  V
GGCCGTACCT ATTATCGTAG CAAATGGTAT AACGATTATG CGGTGAGCGT
CCGGCATGGA TAATAGCATC GTTTACCATA TTGCTAATAC GCCACTCGCA
```

00h2T0"h9006h60

Figure 5G: V heavy chain 6 (VH6) gene sequence (continued)

```
  K  S  R   I  T  I  N   P  D  T   S  K  N   Q  F  S
            BsaBI                   NspV
         ~~~~~~~~~~~~              ~~~~~~~
GAAAAGCCGG ATTACCATCA ACCCGGATAC TTCGAAAAAC CAGTTTAGCC
CTTTTCGGCC TAATGGTAGT TGGGCCTATG AAGCTTTTTG GTCAAATCGG

L  Q  L  N   S  V  T   P  E  D  T   A  V  Y   Y  C  A
                                    EagI          BssHII
                                   ~~~~~~~         ~~~~~
TGCAACTGAA CAGCGTGACC CCGGAAGATA CGGCCGTGTA TTATTGCGCG
ACGTTGACTT GTCGCACTGG GGCCTTCTAT GCCGGCACAT AATAACGCGC

 R  W  G  G   D  G  F   Y  A  M   D  Y  W  G   Q  G  T
BssHII                                          StyI
~                                              ~~~~~~~
CGTTGGGGCG GCGATGGCTT TTATGCGATG GATTATTGGG GCCAAGGCAC
GCAACCCCGC CGCTACCGAA AATACGCTAC CTAATAACCC CGGTTCCGTG

  L  V  T   V  S  S
               BlpI
              ~~~~~~~
CCTGGTGACG GTTAGCTCAG
GGACCACTGC CAATCGAGTC
```

Figure 6: oligonucleotides for gene synthesis

**O1K1** 5'- GAATGCATACGCTGATATCCAGATGACCCAGAG-CCCGTCTAGCCTGAGC -3'

**O1K2** 5'- CGCTCTGCAGGTAATGGTCACACGATCACCCAC-GCTCGCGCTCAGGCTAGACGGGC -3'

**O1K3** 5'- GACCATTACCTGCAGAGCGAGCCAGGGCATTAG-CAGCTATCTGGCGTGGTACCAGCAG -3'

**O1K4** 5'- CTTTGCAAGCTGCTGGCTGCATAAATTAATAGT-TTCGGTGCTTTACCTGGTTTCTGCTGGTACCACGCCAG -3'

**O1K5** 5'- CAGCCAGCAGCTTGCAAAGCGGGGTCCCGTCCC-GTTTTAGCGGCTCTGGATCCGGCACTGATTTTAC -3'

**O1K6** 5'- GATAATAGGTCGCAAAGTCTTCAGGTTGCAGGC-TGCTAATGGTCAGGGTAAAATCAGTGCCGGATCC -3'

**O2K1** 5'- CGATATCGTGATGACCCAGAGCCCACTGAGCCT-GCCAGTGACTCCGGGCGAGCC -3'

**O2K2** 5'- GCCGTTGCTATGCAGCAGGCTTTGGCTGCTTCT-GCAGCTAATGCTCGCAGGCTCGCCCGGAGTCAC -3'

**O2K3** 5'- CTGCTGCATAGCAACGGCTATAACTATCTGGAT-TGGTACCTTCAAAAACCAGGTCAAAGCCC -3'

**O2K4** 5'- CGATCCGGGACCCCACTGGCACGGTTGCTGCCC-AGATAAATTAATAGCTGCGGGCTTTGACCTGGTTTTTG -3'

**O2K5** 5'- AGTGGGGTCCCGGATCGTTTTAGCGGCTCTGGA-TCCGGCACCGATTTTACCCTGAAAATTAGCCGTGTG -3'

**O2K6** 5'- CCATGCAATAATACACGCCCACGTCTTCAGCTT-CCACACGGCTAATTTTCAGGG -3'

**O3K1** 5'- GAATGCATACGCTGATATCGTGCTGACCCAGAG-CCCGG -3'

**O3K2** 5'- CGCTCTGCAGCTCAGGGTCGCACGTTCGCCCGG-AGACAGGCTCAGGGTCGCCGGGCTCTGGGTCAGC -3'

**O3K3** 5'- CCCTGAGCTGCAGAGCGAGCCAGAGCGTGAGCA-GCAGCTATCTGGCGTGGTACCAG -3'

Figure 6: (continued)

**O3K4** 5'- GCACGGCTGCTCGCGCCATAAATTAATAGACGC-GGTGCTTGACCTGGTTTCTGCTGGTACCACGCCAGATAG -3'

**O3K5** 5'- GCGCGAGCAGCCGTGCAACTGGGGTCCCGGCGC-GTTTTAGCGGCTCTGGATCCGGCACGGATTTTAC -3'

**O3K6** 5'- GATAATACACCGCAAAGTCTTCAGGTTCCAGGC-TGCTAATGGTCAGGGTAAAATCCGTGCCGGATC -3'

**O4K1** 5'- GAATGCATACGCTGATATCGTGATGACCCAGAG-CCCGGATAGCCTGGCG -3'

**O4K2** 5'- GCTTCTGCAGTTAATGGTCGCACGTTCGCCCAG-GCTCACCGCCAGGCTATCCGGGC -3'

**O4K3** 5'- CGACCATTAACTGCAGAAGCAGCCAGAGCGTGC-TGTATAGCAGCAACAACAAAAACTATCTGGCGTGGTACCAG -3'

**O4K4** 5'- GATGCCCAATAAATTAATAGTTTCGGCGGCTGA-CCTGGTTTCTGCTGGTACCACGCCAGATAG -3'

**O4K5** 5'- AAACTATTAATTTATTGGGCATCCACCCGTGAA-AGCGGGGTCCCGGATCGTTTTAGCGGCTCTGGATCCGGCAC-3'

**O4K6** 5'- GATAATACACCGCCACGTCTTCAGCTTGCAGGG-ACGAAATGGTCAGGGTAAAATCAGTGCCGGATCCAGAGCC -3'

**O1L1** 5'- GAATGCATACGCTCAGAGCGTGCTGACCCAGCC-GCCTTCAGTGAGTGG -3'

**O1L2** 5'- CAATGTTGCTGCTGCTGCCGCTACACGAGATGG-TCACACGCTGACCTGGTGCGCCACTCACTGAAGGCGGC -3'

**O1L3** 5'- GGCAGCAGCAGCAACATTGGCAGCAACTATGTG-AGCTGGTACCAGCAGTTGCCCGGGAC -3'

**O1L4** 5'- CCGGCACGCCTGAGGGACGCTGGTTGTTATCAT-AAATCAGCAGTTTCGGCGCCGTCCCGGGCAACTGC -3'

**O1L5** 5'- CCCTCAGGCGTGCCGGATCGTTTTAGCGGATCC-AAAAGCGGCACCAGCGCGAGCCTTGCG -3'



00470"49005460

Figure 6: (continued)

**O1L6** 5'- CCGCTTCGTCTTCGCTTTGCAGGCCCGTAATCG-CAAGGCTCGCGCTGG -3'

**O2L1** 5'- GAATGCATACGCTCAGAGCGCACTGACCCAGCC-AGCTTCAGTGAGCGGC -3'

**O2L2** 5'- CGCTGCTAGTACCCGTACACGAGATGGTAATGC-TCTGACCTGGTGAGCCGCTCACTGAAGCTGG -3'

**O2L3** 5'- GTACGGGTACTAGCAGCGATGTGGCGGCTATA-ACTATGTGAGCTGGTACCAGCAGCATCCCGG -3'

**O2L4** 5'- CGCCTGAGGGACGGTTGCTCACATCATAAATCA-TCAGTTTCGGCGCCTTCCCGGGATGCTGCTGGTAC -3'

**O2L5** 5'- CAACCGTCCCTCAGGCGTGAGCAACCGTTTTAG-CGGATCCAAAAGCGGCAACACCGCGAGCC -3'

**O2L6** 5'- CCGCTTCGTCTTCCGCTTGCAGGCCGCTAATGG-TCAGGCTCGCGGTGTTGCCG -3'

**O3L1** 5'- GAATGCATACGCTAGCTATGAACTGACCCAGCC-GCCTTCAGTGAGCG -3'

**O3L2** 5'- CGCCCAGCGCATCGCCGCTACACGAGATACGCG-CGGTCTGACCTGGTGCAACGCTCACTGAAGGCGGC -3'

**O3L3** 5'- GGCGATGCGCTGGGCGATAAATACGCGAGCTGG-TACCAGCAGAAACCCGGGCAGGCGC -3'

**O3L4** 5'- GCGTTCCGGGATGCCTGAGGGACGGTCAGAATC-ATCATAAATCACCAGAACTGGCGCCTGCCCGGGTTTC -3'

**O3L5** 5'- CAGGCATCCCGGAACGCTTTAGCGGATCCAACA-GCGGCAACACCGCGACCCTGACCATTAGCGG -3'

**O3L6** 5'- CCGCTTCGTCTTCCGCCTGAGTGCCGCTAATGG-TCAGGGTC -3'

**O1246H1** 5'- GCTCTTCACCCCTGTTACCAAAGCCCAG-GTGCAATTG -3'

**O1AH2** 5'- GGCTTTGCAGCTCACTTTCACGCTGCTGCCCGG-TTTTTTCACTTCCGCGCCAGACTGAACCAATTGCACCTGGGC-TTTG -3'

Figure 6: (continued)

**O1AH3** 5'- GAAAGTGAGCTGCAAAGCCTCCGGAGGCACTTT-TAGCAGCTATGCGATTAGCTGGGTGCGCCAAGCCCCTGGGCAGGGTC -3'

**O1AH4** 5'- GCCCTGAAACTTCTGCGCGTAGTTCGCCGTGCC-AAAAATCGGAATAATGCCGCCCATCCACTCGAGACCCTGCCC-AGGGGC -3'

**O1AH5** 5'- GCGCAGAAGTTTCAGGGCCGGGTGACCATTACC-GCGGATGAAAGCACCAGCACCGCGTATATGGAACTGAGCAGCCTGCG -3'

**O1ABH6** 5'- GCGCGCAATAATACACGGCCGTATCTTCGCT-ACGCAGGCTGCTCAGTTCC -3'

**O1BH2** 5'- GGCTTTGCAGCTCACTTTCACGCTCGCGCCCGG-TTTTTTCACTTCCGCGCCGCTCTGAACCAATTGCACCTGGGC-TTTG -3'

**O1BH3** 5'- GAAAGTGAGCTGCAAAGCCTCCGGATATACCTT-TACCAGCTATTATATGCACTGGGTCCGCCAAGCCCCTGGGCAGGGTC -3'

**O1BH4** 5'- GCCCTGAAACTTCTGCGCGTAGTTCGTGCCGCC-GCTATTCGGGTTAATCCAGCCCATCCACTCGAGACCCTGCCCAGGGGC -3'

**O1BH5** 5'- GCGCAGAAGTTTCAGGGCCGGGTGACCATGACC-CGTGATACCAGCATTAGCACCGCGTATATGGAACTGAGCAGCCTGCG -3'

**O2H2** 5'- GGTACAGGTCAGGGTCAGGGTTTGGGTCGGTTT-CACCAGGGCCGGGCCGCTTTCTTTCAATTGCACCTGGGCTTTG -3'

**O2H3** 5'- CTGACCCTGACCTGTACCTTTTCCGGATTTAGC-CTGTCCACGTCTGGCGTTGGCGTGGGCTGGATTCGCCAGCCGCCTGGGAAAG -3'

**O2H4** 5'- GCGTTTTCAGGCTGGTGCTATAATACTTATCAT-CATCCCAATCAATCAGAGCCAGCCACTCGAGGGCTTTCCCAGGCGGCTGG -3'

Figure 6: (continued)

**O2H5** 5'- GCACCAGCCTGAAAACGCGTCTGACCATTAGCA-AAGATACTTCGAAAAATCAGGTGGTGCTGACTATGACCAACATGG -3'

**O2H6** 5'- GCGCGCAATAATAGGTGGCCGTATCCACCGGGT-CCATGTTGGTCATAGTCAGC -3'

**O3H1** 5'- CGAAGTGCAATTGGTGGAAAGCGGCGGCCT-GGTGCAACCGGGCGGCAG -3'

**O3H2** 5'- CATAGCTGCTAAAGGTAAATCCGGAGGCCGCGC-AGCTCAGACGCAGGCTGCCGCCCGGTTGCAC -3'

**O3H3** 5'- GATTTACCTTTAGCAGCTATGCGATGAGCTGGG-TGCGCCAAGCCCCTGGGAAGGGTCTCGAGTGGGTGAG -3'

**O3H4** 5'- GGCCTTTCACGCTATCCGCATAATAGGTGCTGC-CGCCGCTACCGCTAATCGCGCTCACCCACTCGAGACCC -3'

**O3H5** 5'- CGGATAGCGTGAAAGGCCGTTTTACCATTTCAC-GTGATAATTCGAAAAACACCCTGTATCTGCAAATGAACAG-3'

**O3H6** 5'- CACGCGCGCAATAATACACGGCCGTATCTTCCG-CACGCAGGCTGTTCATTTGCAGATACAGG -3'

**O4H2** 5'- GGTCAGGCTCAGGGTTTCGCTC[illegible]TTTCACCAG-GCCCGGACCACTTTCTTGCAATTGCACCTGGGCTTTG -3'

**O4H3** 5'- GAAACCCTGAGCCTGACCTGCACCGTTTCCGGA-GGCAGCATTAGCAGCTATTATTGGAGCTGGATTCGCCAGCCGC -3'

**O4H4** 5'- GATTATAGTTGGTGCTGCCGCTATAATAAATAT-AGCCAATCCACTCGAGACCCTTCCCAGGCGGCTGGCGAATCCAG -3'

**O4H5** 5'- CGGCAGCACCAACTATAATCCGAGCCTGAAAAG-CCGGGTGACCATTAGCGTTGATACTTCGAAAAACCAGTTTAGCCTG -3'

**O4H6** 5'- GCGCGCAATAATACACGGCCGTATCCGCCGCCG-TCACGCTGCTCAGTTTCAGGCTAAACTGGTTTTTCG -3'

Figure 6: (continued)

**O5H1** 5'- GCTCTTCACCCCTGTTACCAAAGCCGAAGTGCA-
ATTG -3'

**O5H2** 5'- CCTTTGCAGCTAATTTTCAGGCTTTCGCCCGGT-
TTTTTCACTTCCGCGCCGCTCTGAACCAATTGCACTTCGGCTT
TGG -3'

**O5H3** 5'- CCTGAAAATTAGCTGCAAAGGTTCCGGATATTC-
CTTTACGAGCTATTGGATTGGCTGGGTGCGCCAGATGCCTGG
-3'

**O5H4** 5'- CGGAGAATAACGGGTATCGCTATCGCCCGGATA-
AATAATGCCCATCCACTCGAGACCCTTCCCAGGCATCTGGCGC
AC -3'

**O5H5** 5'- CGATACCCGTTATTCTCCGAGCTTTCAGGGCCA-
GGTGACCATTAGCGCGGATAAAAGCATTAGCACCGCGTATCTT
C -3'

**O5H6** 5'- GCGCGCAATAATACATGGCCGTATCGCTCGCTT-
TCAGGCTGCTCCATTGAAGATACGCGGTGCTAATG -3'

**O6H2** 5'- GAAATCGCACAGGTCAGGCTCAGGGTTTGGCTC-
GGTTTCACCAGGCCCGGACCAGACTGTTGCAATTGCACCTGG-
GCTTTG -3'

**O6H3** 5'- GCCTGACCTGTGCGATTTCCGGAGATAGCGTGA-
GCAGCAACAGCGCGGCGTGGAACTGGATTCGCCAGTCTCCTGG
GCG -3'

**O6H4** 5'- CACCGCATAATCGTTATACCATTTGCTACGATA-
ATAGGTACGGCCCAGCCACTCGAGGCCACGCCCAGGAGACTG-
GCG -3'

**O6H5** 5'- GGTATAACGATTATGCGGTGAGCGTGAAAAGCC-
GGATTACCATCAACCCGGATACTTCGAAAAACCAGTTTAGCCT
GC -3'

**O6H6** 5'- GCGCGCAATAATACACGGCCGTATCTTCCGGGG-
TCACGCTGTTCAGTTGCAGGCTAAACTGGTTTTTC -3'

**OCLK1** 5'- GGCTGAAGACGTGGGCGTGTATTATTGCCAGCA-
GCATTATACCACCCCGCCGACCTTTGGCCAGGGTAC -3'

Figure 6: (continued)

**OCLK2** 5'- GCGGAAAAATAAACACGCTCGGAGCAGCCACCG-TACGTTTAATTTCAACTTTCGTACCCTGGCCAAAGGTC -3'

**OCLK3** 5'- GAGCGTGTTTATTTTTCCGCCGAGCGATGAACA-ACTGAAAAGCGGCACGGCGAGCGTGGTGTGCCTGCTG -3'

**OCLK4** 5'- CAGCGCGTTGTCTACTTTCCACTGAACTTTCGC-TTCACGCGGATAAAAGTTGTTCAGCAGGCACACCACGC -3'

**OCLK5** 5'- GAAAGTAGACAACGCGCTGCAAAGCGGCAACAG-CCAGGAAAGCGTGACCGAACAGGATAGCAAAGATAG -3'

**OCLK6** 5'- GTTTTTCATAATCCGCTTTGCTCAGGGTCAGGG-TGCTGCTCAGAGAATAGGTGCTATCTTTGCTATCCTGTTCG -3'

**OCLK7** 5'- GCAAAGCGGATTATGAAAAACATAAAGTGTATG-CGTGCGAAGTGACCCATCAAGGTCTGAGCAGCCCGGTG -3'

**OCLK8** 5'- GGCATGCTTATCAGGCCTCGCCACGATTAAAAG-ATTTAGTCACCGGGCTGCTCAGAC -3'

**OCH1** 5'- GGCGTCTAGAGGCCAAGGCACCCTGGTGACGGT-TAGCTCAGCGTCGAC -3'

**OCH2** 5'- GTGCTTTTGCTGCTCGGAGCCAGCGGAAACACG-CTTGGACCTTTGGTCGACGCTGAGCTAACC -3'

**OCH3** 5'- CTCCGAGCAGCAAAAGCACCAGCGGCGGCACGG-CTGCCCTGGGCTGCCTGGTTAAAGATTATTTCC -3'

**OCH4** 5'- CTGGTCAGCGCCCCGCTGTTCCAGCTCACGGTG-ACTGGTTCCGGGAAATAATCTTTAACCAGGCA -3'

**OCH5** 5'- AGCGGGGCGCTGACCAGCGGCGTGCATACCTTT-CCGGCGGTGCTGCAAAGCAGCGGCCTG -3'

**OCH6** 5'- GTGCCTAAGCTGCTGCTCGGCACGGTCACAACG-CTGCTCAGGCTATACAGGCCGCTGCTTTGCAG -3'

**OCH7** 5'- GAGCAGCAGCTTAGGCACTCAGACCTATATTTG-CAACGTGAACCATAAACCGAGCAACACC -3'

**OCH8** 5'- GCGCGAATTCGCTTTTCGGTTCCACTTTTTTAT-CCACTTTGGTGTTGCTCGGTTTATGG -3'

Figure 7A: sequence of the synthetic Cκ gene segment

```
   V  A   A  P  S   V  F  I   F  P  P  S   D  E  Q
BsiWI
-------
CGTACGGTGG CTGCTCCGAG CGTGTTTATT TTTCCGCCGA GCGATGAACA
GCATGCCACC GACGAGGCTC GCACAAATAA AAAGGCGGCT CGCTACTTGT

 L  K  S   G  T  A  S   V  V  C   L  L  N   N  F  Y
ACTGAAAAGC GGCACGGCGA GCGTGGTGTG CCTGCTGAAC AACTTTTATC
TGACTTTTCG CCGTGCCGCT CGCACCACAC GGACGACTTG TTGAAAATAG

P  R  E  A   K  V  Q   W  K  V  D   N  A  L   Q  S  G
CGCGTGAAGC GAAAGTTCAG TGGAAAGTAG ACAACGCGCT GCAAAGCGGC
GCGCACTTCG CTTTCAAGTC ACCTTTCATC TGTTGCGCGA CGTTTCGCCG

 N  S  Q  E   S  V  T   E  Q  D   S  K  D  S   T  Y  S
AACAGCCAGG AAAGCGTGAC CGAACAGGAT AGCAAAGATA GCACCTATTC
TTGTCGGTCC TTTCGCACTG GCTTGTCCTA TCGTTTCTAT CGTGGATAAG

 L  S  S   T  L  T  L   S  K  A   D  Y  E   K  H  K
TCTGAGCAGC ACCCTGACCC TGAGCAAAGC GGATTATGAA AAACATAAAG
AGACTCGTCG TGGGACTGGG ACTCGTTTCG CCTAATACTT TTTGTATTTC
```

Figure 7A: sequence of the synthetic Cκ gene segment (continued)

```
V  Y  A  C   E  V  T   H  Q  G  L   S  S  P   V  T  K
TGTATGCGTG CGAAGTGACC CATCAAGGTC TGAGCAGCCC GGTGACTAAA
ACATACGCAC GCTTCACTGG GTAGTTCCAG ACTCGTCGGG CCACTGATTT

 S  F  N  R   G  E  A  *
                StuI        SphI
              ~~~~~~~~     ~~~~~~
TCTTTTAATC GTGGCGAGGC CTGATAAGCA TGC
AGAAAATTAG CACCGCTCCG GACTATTCGT ACG
```

Figure 7B: sequence of the synthetic CH1 gene segment

```
     A  S   T  K  G   P  S  V  F   P  L  A   P  S  S
 BlpI   SalI
~~~~~~~~~~~~~~~
GCTCAGCGTC GACCAAAGGT CCAAGCGTGT TTCCGCTGGC TCCGAGCAGC
CGAGTCGCAG CTGGTTTCCA GGTTCGCACA AAGGCGACCG AGGCTCGTCG

 K  S  T  S   G  G  T   A  A  L   G  C  L  V   K  D  Y
AAAAGCACCA GCGGCGGCAC GGCTGCCCTG GGCTGCCTGG TTAAAGATTA
TTTTCGTGGT CGCCGCCGTG CCGACGGGAC CCGACGGACC AATTTCTAAT

  F  P  E   P  V  T  V   S  W  N   S  G  A   L  T  S
TTTCCCGGAA CCAGTCACCG TGAGCTGGAA CAGCGGGGCG CTGACCAGCG
AAAGGGCCTT GGTCAGTGGC ACTCGACCTT GTCGCCCCGC GACTGGTCGC

G  V  H  T   F  P  A   V  L  Q  S   S  G  L   Y  S  L
GCGTGCATAC CTTTCCGGCG GTGCTGCAAA GCAGCGGCCT GTATAGCCTG
CGCACGTATG GAAAGGCCGC CACGACGTTT CGTCGCCGGA CATATCGGAC

 S  S  V  V   T  V  P   S  S  S   L  G  T  Q   T  Y  I
AGCAGCGTTG TGACCGTGCC GAGCAGCAGC TTAGGCACTC AGACCTATAT
TCGTCGCAAC ACTGGCACGG CTCGTCGTCG AATCCGTGAG TCTGGATATA
```

00420.49006490

Figure 7B: sequence of the synthetic CH1 gene segment (continued)

```
 C  N  V   N  H  K  P   S  N  T   K  V  D   K  K  V
TTGCAACGTG AACCATAAAC CGAGCAACAC CAAAGTGGAT AAAAAAGTGG
AACGTTGCAC TTGGTATTTG GCTCGTTGTG GTTTCACCTA TTTTTTCACC

 E  P  K  S   E  F  *
              EcoRI      HindIII
             ~~~~~~      ~~~~~~
AACCGAAAAG CGAATTCTGA TAAGCTT
TTGGCTTTTC GCTTAAGACT ATTCGAA
```

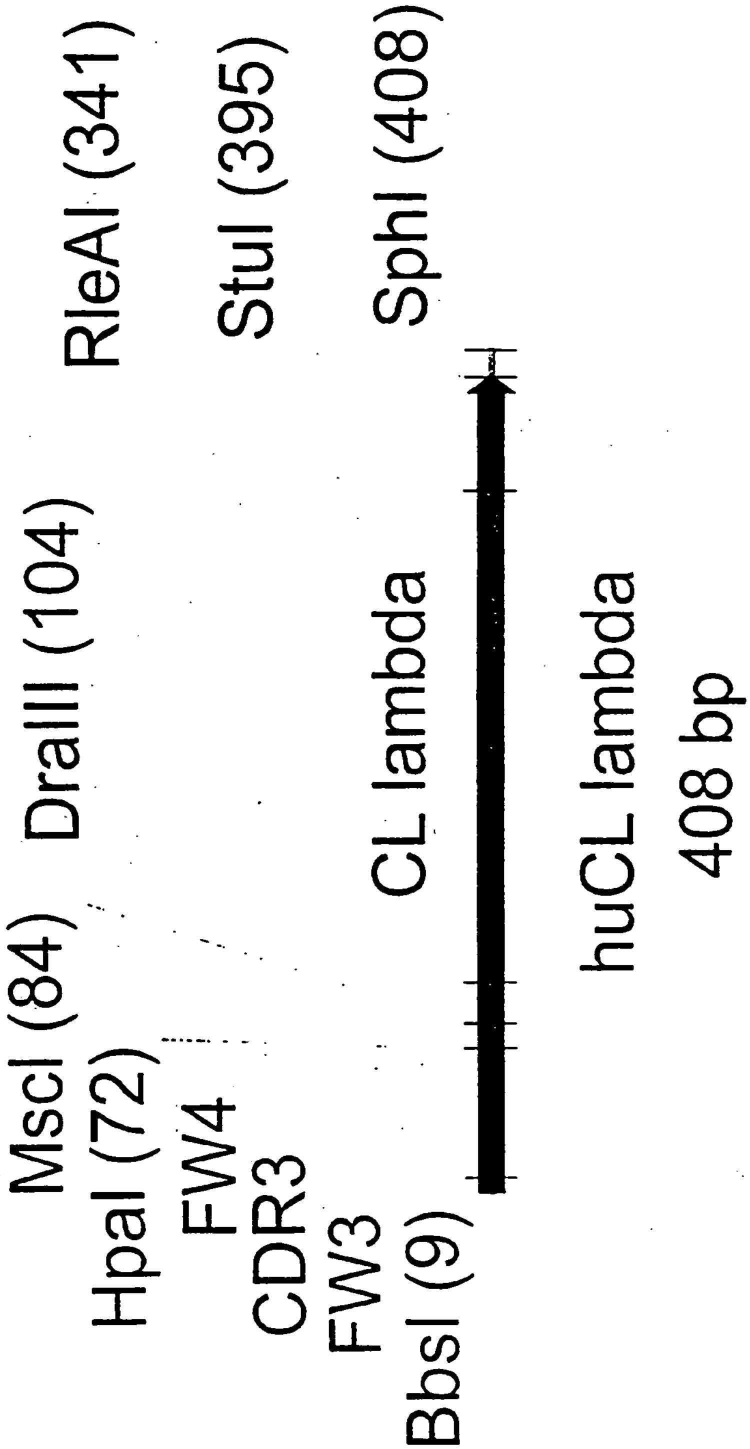


Figure 7C: functional map and sequence of module 24 comprising the synthetic Cλ gene segment (huCL lambda)

Figure 7C: functional map and sequence of module 24 comprising the synthetic CI gene segment (huCL lambda) (continued)

```
      BbsI
     ~~~~~~~
  1  GAAGACGAAG CGGATTATTA TTGCCAGCAG CATTATACCA CCCCGCCTGT
     CTTCTGCTTC GCCTAATAAT AACGGTCGTC GTAATATGGT GGGGCGGACA

                            HpaI          MscI          DraIII
                          ~~~~~~~~      ~~~~~~              ~~~
 51  GTTTGGCGGC GGCACGAAGT TAACCGTTCT TGGCCAGCCG AAAGCCGCAC
     CAAACCGCCG CCGTGCTTCA ATTGGCAAGA ACCGGTCGGC TTTCGGCGTG

     DraIII
     ~~~~~~
101  CGAGTGTGAC GCTGTTTCCG CCGAGCAGCG AAGAATTGCA GGCGAACAAA
     GCTCACACTG CGACAAAGGC GGCTCGTCGC TTCTTAACGT CCGCTTGTTT

151  GCGACCCTGG TGTGCCTGAT TAGCGACTTT TATCCGGGAG CCGTGACAGT
     CGCTGGGACC ACACGGACTA ATCGCTGAAA ATAGGCCCTC GGCACTGTCA

201  GGCCTGGAAG GCAGATAGCA GCCCCGTCAA GGCGGGAGTG GAGACCACCA
     CCGGACCTTC CGTCTATCGT CGGGGCAGTT CCGCCCTCAC CTCTGGTGGT
```

Figure 7C: functional map and sequence of module 24 comprising the synthetic CI gene segment (huCL lambda) (continued)

```
251  CACCCTCCAA ACAAAGCAAC AACAAGTACG CGGCCAGCAG CTATCTGAGC
     GTGGGAGGTT TGTTTCGTTG TTGTTCATGC GCCGGTCGTC GATAGACTCG

                             RleAI
                             ~~~~~~
301  CTGACGCCTG AGCAGTGGAA GTCCCACAGA AGCTACAGCT GCCAGGTCAC
     GACTGCGGAC TCGTCACCTT CAGGGTGTCT TCGATGTCGA CGGTCCAGTG

                                                  StuI
                                                  ~~~~~~
351  GCATGAGGGG AGCACCGTGG AAAAAACCGT TGCGCCGACT GAGGCCTGAT
     CGTACTCCCC TCGTGGCACC TTTTTGGCA ACGCGGCTGA CTCCGGACTA

       SphI
       ~~~~~~
401  AAGCATGC
     TTCGTACG
```

09006490.012400

Figure 7D: oligonucleotides used for synthesis of module M24 containing Cλ gene segment

M24: assembly PCR

M24-A: GAAGACAAGCGGATTATTATTGCCAGCAGCATTATACCACCCCGCCTGTGTTTGGCGGCG-
GCACGAAGTTAACCGTTC

M24-B: CAATTCTTCGCTGCTCGGCGGAAACAGCGTCACACTCGGTGCGGCTTTCGGCTGGCCAA-
GAACGGTTAACTTCGTGCCGC

M24-C: CGCCGAGCAGCGAAGAATTGCAGGCGAACAAAGCGACCCTGGTGTGCCTGATTAGCGACT-
TTTATCCGGGAGCCGTGACA

M24-D: TGTTTGGAGGGTGTGGTGGTCTCCACTCCCGCCTTGACGGGGCTGCTATCTGCCTTCCAG-
GCCACTGTCACGGCTCCCGG

M24-E: CCACACCCTCCAAACAAAGCAACAACAAGTACGCGGCCAGCAGCTATCTGAGCCTGACGC-
CTGAGCAGTGGAAGTCCCACAGAAGCTACAGCTG

M24-F: GCATGCTTATCAGGCCTCAGTCGGCGCAACGGTTTTTTCCACGGTGCTCCCCTCATGCGT-
GACCTGGCAGCTGTAGCTTC

00420104 19006460

Figure 8: sequence and restriction map of the synthetic gene encoding the consensus single-chain fragment VH3-Vκ2

```
 M  K  Q  S   T  I  A   L  A  L   L  P  L  L   F  T  P
                                      SapI
                                    ~~~~~~~~~
ATGAAACAAA GCACTATTGC ACTGGCACTC TTACCGTTGC TCTTCACCCC
TACTTTGTTT CGTGATAACG TGACCGTGAG AATGGCAACG AGAAGTGGGG

  V  T  K   A  D  Y  K   D  E  V   Q  L  V   E  S  G
                                   MfeI
                                 ~~~~~~~
TGTTACCAAA GCCGACTACA AAGATGAAGT GCAATTGGTG GAAAGCGGCG
ACAATGGTTT CGGCTGATGT TTCTACTTCA CGTTAACCAC CTTTCGCCGC

G  G  L  V   Q  P  G   G  S  L  R   L  S  C   A  A  S
                                                BspEI
                                                  ~~~
GCGGCCTGGT GCAACCGGGC GGCAGCCTGC GTCTGAGCTG CGCGGCCTCC
CGCCGGACCA CGTTGGCCCG CCGTCGGACG CAGACTCGAC GCGCCGGAGG

 G  F  T  F   S  S  Y   A  M  S   W  V  R  Q   A  P  G
BspEI                                        BstXI
~~~                                     ~~~~~~~~~~~~~
GGATTTACCT TTAGCAGCTA TGCGATGAGC TGGGTGCGCC AAGCCCCTGG

CCTAAATGGA AATCGTCGAT ACGCTACTCG ACCCACGCGG TTCGGGGACC
```

00424014.9006460

Figure 8: sequence and restriction map of the synthetic gene encoding the consensus single-chain fragment VH3-Vκ2 (continued)

```
  K  G  L   E  W  V  S   A  I  S   G  S  G   G  S  T
        XhoI
       ~~~~~~~~
GAAGGGTCTC GAGTGGGTGA GCGCGATTAG CGGTAGCGGC GGCAGCACCT
CTTCCCAGAG CTCACCCACT CGCGCTAATC GCCATCGCCG CCGTCGTGGA

Y  Y  A  D   S  V  K   G  R  F  T   I  S  R   D  N  S
                                      PmlI       NspV
                                    ~~~~~~~~    ~~~~
ATTATGCGGA TAGCGTGAAA GGCCGTTTTA CCATTTCACG TGATAATTCG
TAATACGCCT ATCGCACTTT CCGGCAAAAT GGTAAAGTGC ACTATTAAGC

 K  N  T  L   Y  L  Q   M  N  S   L  R  A  E   D  T  A
NspV                                              EagI
~~                                                ~~~~
AAAAACACCC TGTATCTGCA AATGAACAGC CTGCGTGCGG AAGATACGGC
TTTTTGTGGG ACATAGACGT TTACTTGTCG GACGCACGCC TTCTATGCCG

  V  Y  Y   C  A  R  W   G  G  D   G  F  Y   A  M  D
EagI        BssHII
~~          ~~~~~~
CGTGTATTAT TGCGCGCGTT GGGGCGGCGA TGGCTTTTAT GCGATGGATT
```

Figure 8: sequence and restriction map of the synthetic gene encoding the consensus single-chain fragment VH3-Vκ2 (continued)

```
GCACATAATA ACGCGCGCAA CCCCGCCGCT ACCGAAAATA CGCTACCTAA
Y  W  G  Q    G  T  L    V  T  V  S    S  A  G    G  G  S
         StyI                             BlpI
       ~~~~~~~~                         ~~~~~~~~
ATTGGGGCCA AGGCACCCTG GTGACGGTTA GCTCAGCGGG TGGCGGTTCT
TAACCCCGGT TCCGTGGGAC CACTGCCAAT CGAGTCGCCC ACCGCCAAGA

 G  G  G  G    S  G  G    G  G  S    G  G  G  G    S  D  I
                                                  EcoRV
                                                  ~~~~~
GGCGGCGGTG GGAGCGGTGG CGGTGGTTCT GGCGGTGGTG GTTCCGATAT
CCGCCGCCAC CCTCGCCACC GCCACCAAGA CCGCCACCAC CAAGGCTATA

 V  M  T    Q  S  P  L    S  L  P    V  T  P    G  E  P
EcoRV          BanII
~            ~~~~~~
CGTGATGACC CAGAGCCCAC TGAGCCTGCC AGTGACTCCG GGCGAGCCTG
GCACTACTGG GTCTCGGGTG ACTCGGACGG TCACTGAGGC CCGCTCGGAC

A  S  I  S    C  R  S    S  Q  S  L    L  H  S    N  G  Y
             PstI
            ~~~~~~
CGAGCATTAG CTGCAGAAGC AGCCAAAGCC TGCTGCATAG CAACGGCTAT
GCTCGTAATC GACGTCTTCG TCGGTTTCGG ACGACGTATC GTTGCCGATA
```

Figure 8: sequence and restriction map of the synthetic gene encoding the consensus single-chain fragment VH3-Vκ2 (continued)

```
 N  Y  L  D   W  Y  L   Q  K  P   G  Q  S  P   Q  L  L
               KpnI          SexAI                AseI
              ~~~~~~~       ~~~~~~~~~             ~~~
AACTATCTGG ATTGGTACCT TCAAAAACCA GGTCAAAGCC CGCAGCTATT
TTGATAGACC TAACCATGGA AGTTTTTGGT CCAGTTTCGG GCGTCGATAA

  I  Y  L   G  S  N  R   A  S  G   V  P  D   R  F  S
AseI                             Eco0109I
~~~                               ~~~~~~~~~
AATTTATCTG GGCAGCAACC GTGCCAGTGG GGTCCCGGAT CGTTTTAGCG
TTAAATAGAC CCGTCGTTGG CACGGTCACC CCAGGGCCTA GCAAAATCGC

G  S  G  S   G  T  D   F  T  L  K   I  S  R   V  E  A
      BamHI
     ~~~~~~~~
GCTCTGGATC CGGCACCGAT TTTACCCTGA AAATTAGCCG TGTGGAAGCT
CGAGACCTAG GCCGTGGCTA AAATGGGACT TTTAATCGGC ACACCTTCGA

 E  D  V  G   V  Y  Y   C  Q  Q   H  Y  T  T   P  P  T
 BbsI
~~~~~~~
GAAGACGTGG GCGTGTATTA TTGCCAGCAG CATTATACCA CCCCGCCGAC
CTTCTGCACC CGCACATAAT AACGGTCGTC GTAATATGGT GGGGCGGCTG
```

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Figure 8: sequence and restriction map of the synthetic gene encoding the consensus single-chain fragment VH3-Vκ2 (continued)

```
 F  G  Q   G  T  K  V   E  I  K   R  T  E   F
   MscI                            BsiWI EcoRI
  ------                          ~~~~~~~~~~~~~
CTTTGGCCAG GGTACGAAAG TTGAAATTAA ACGTACGGAA TTC
GAAACCGGTC CCATGCTTTC AACTTTAATT TGCATGCCTT AAG
```

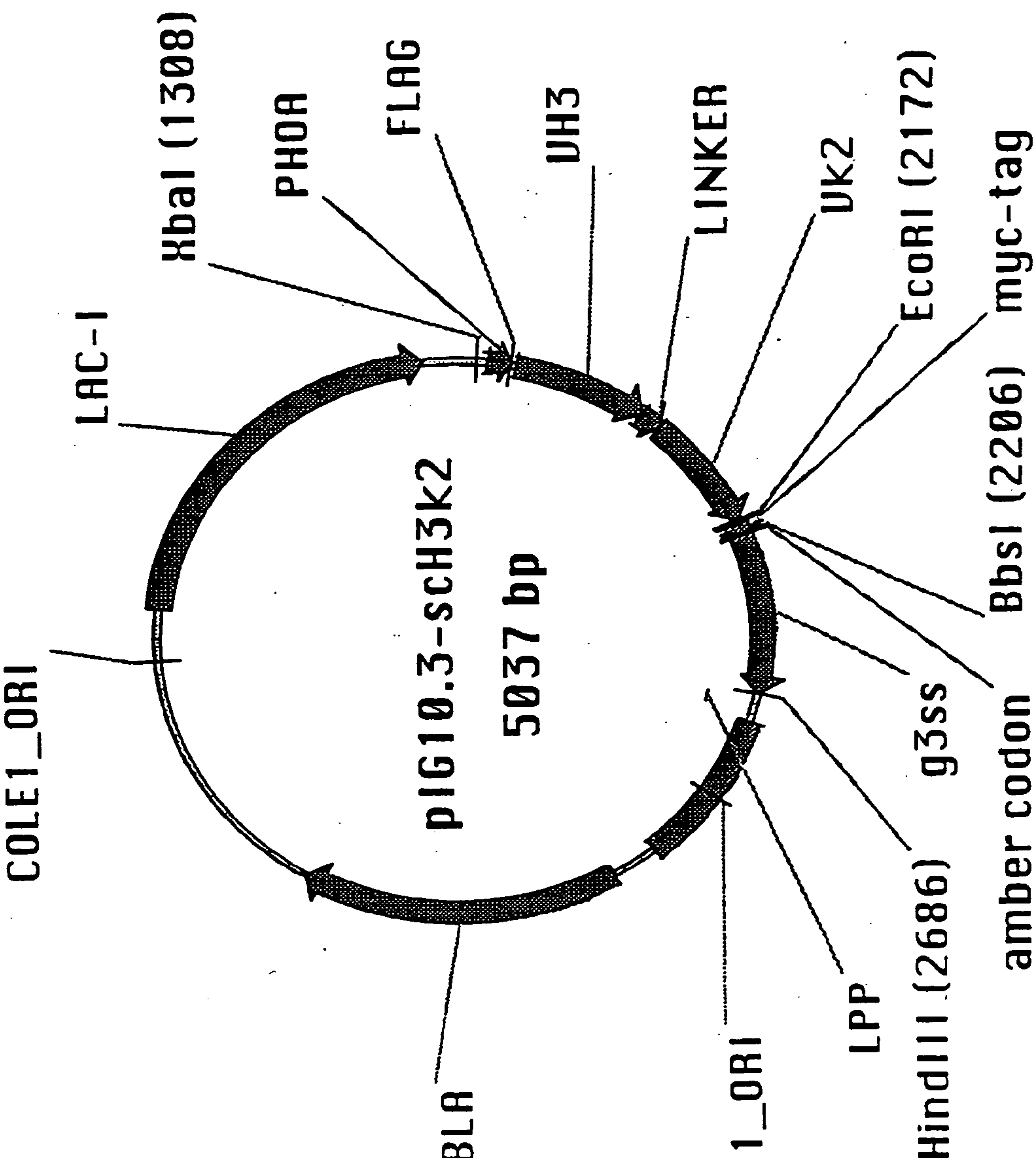



Figure 9: Phage display vector pIG10.3

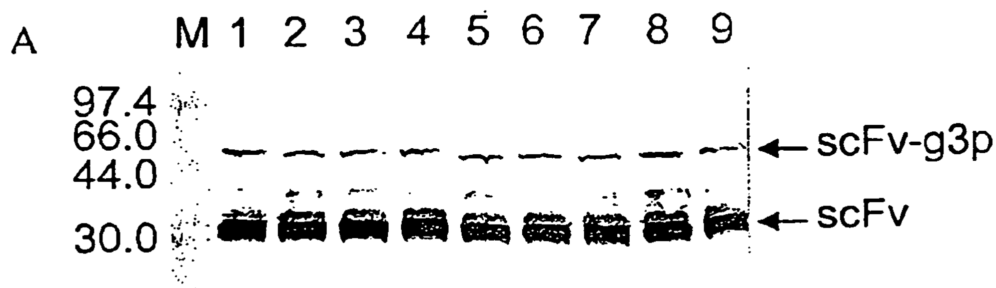
Figure 10: Sequence analysis of initial libraries

| | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 100A | 100B | 100C | 100D | 100E | 101 | 102 | 103 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | C | A | R | W | G | G | D | G | F | Y | A | - | - | M | D | Y | W |
| B | C | A | R | F | G | K | M | N | Y | - | - | - | - | - | D | Y | W |
| | C | A | R | H | R | T | E | W | H | - | - | - | - | - | D | Y | W |
| | C | A | R | V | R | E | L | Y | H | - | - | - | - | - | D | Y | W |
| | C | A | R | K | F | L | K | A | R | - | - | - | - | - | D | Y | W |
| | C | A | R | W | N | T | T | G | Y | - | - | - | - | - | D | Y | W |
| | C | A | R | I | N | E | A | Q | P | - | - | - | - | - | D | Y | W |
| | C | A | R | T | A | I | T | R | - | - | - | - | - | - | D | Y | W |
| | C | A | R | W | Y | N | R | N | S | - | - | - | - | - | D | Y | W |
| | C | A | R | S | V | G | D | S | K | - | - | - | - | - | D | Y | W |
| | C | A | R | S | K | T | F | A | A | - | - | - | - | - | D | Y | W |
| | C | A | R | V | A | P | Q | Y | D | - | - | - | - | - | D | Y | W |
| | C | A | R | M | Q | S | E | W | M | - | - | - | - | - | D | Y | W |

Figure 10: Sequence analysis of initial libraries

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | C | A | R | Y | F | V | H | F | L | Y | T | M | V | M | D | V | W |
| | C | A | R | M | A | L | R | A | S | G | K | Y | I | M | D | V | W |
| | C | A | R | K | N | Q | M | V | F | H | A | R | K | F | D | V | W |
| | C | A | R | T | Q | S | F | W | E | Q | Q | K | V | M | D | Y | W |
| | C | A | R | Y | P | Y | R | S | N | F | F | M | P | M | D | V | W |
| | C | A | R | * | G | S | G | S | E | H | W | S | I | F | D | V | W |
| | C | A | R | R | N | P | W | N | V | N | Y | L | H | F | D | V | W |
| | C | A | R | M | K | P | M | L | N | R | D | G | T | M | D | V | W |
| | C | A | R | K | G | S | E | F | L | E | T | D | V | M | D | Y | W |
| | C | A | R | S | W | T | N | D | K | P | N | F | I | M | D | V | W |
| | C | A | R | Y | A | G | T | T | F | K | Q | G | P | M | D | Y | W |

Figure 11: Expression analysis of initial library



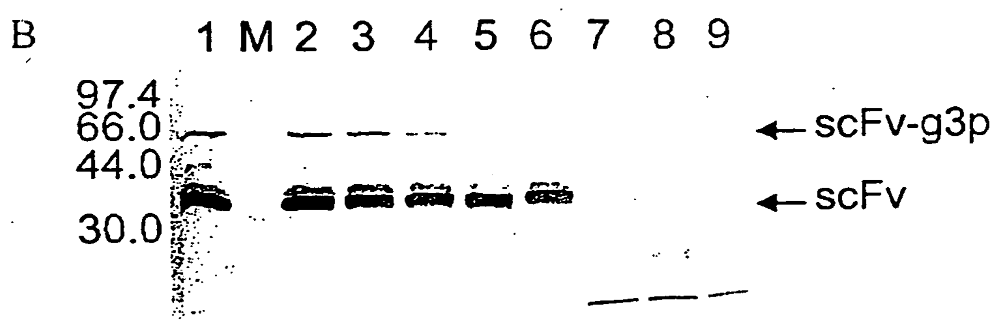
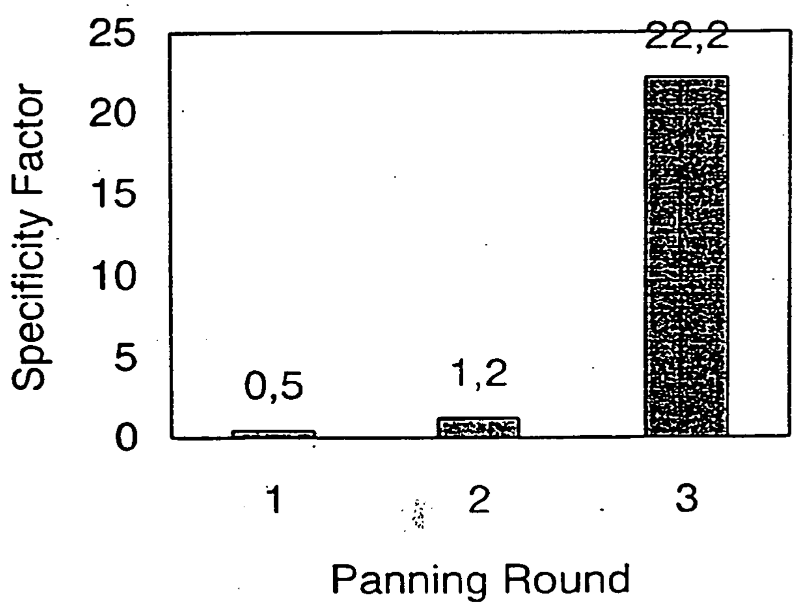



Figure 12: Increase of specificity during the panning rounds



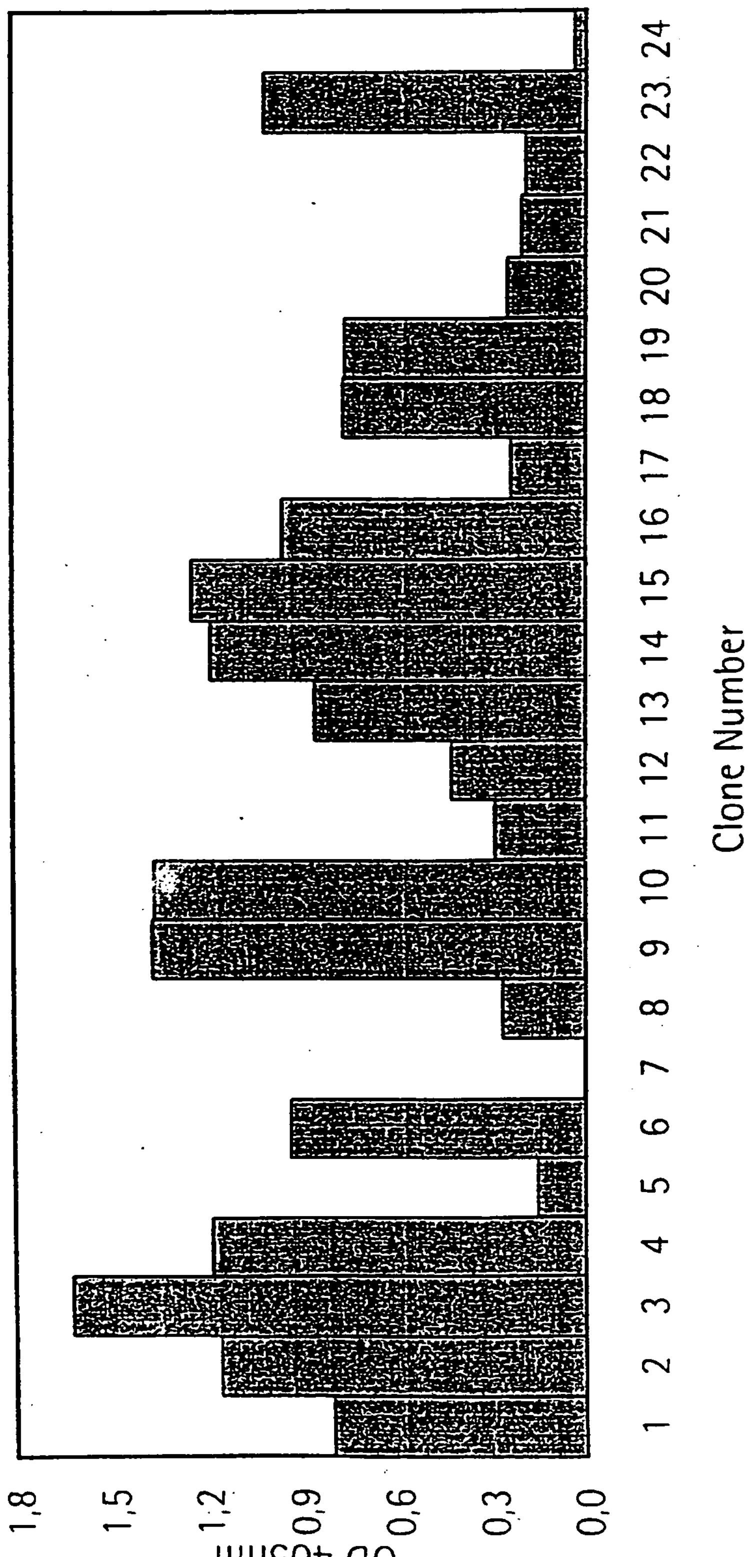



Figure 13: Phage ELISA of clones after the 3rd round of panning


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Figure 14: Competition ELISA

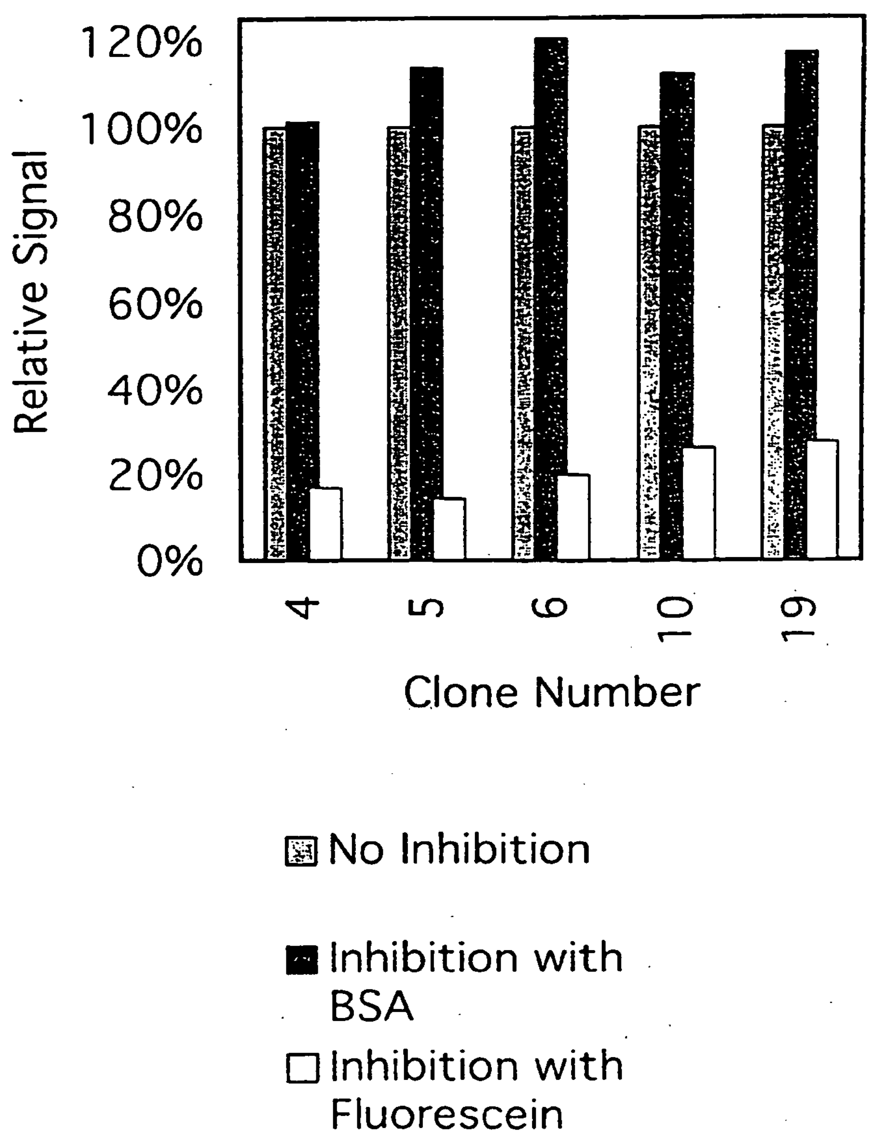


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Figure 15: Sequence analysis of fluorescein binders

| 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 100A | 100B | 100C | 100D | 100E | 101 | 102 | 103 | Frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | A | R | K | R | M | M | Q | N | P | R | F | R | F | D | V | W | 1 |
| C | A | R | R | S | K | Q | K | R | K | M | R | R | F | D | V | W | 3 |
| C | A | R | R | N | G | K | R | H | L | R | H | R | F | D | V | W | 1 |
| C | A | R | R | K | M | R | K | R | I | K | R | R | F | D | V | W | 2 |
| C | A | R | Y | R | K | I | M | K | W | K | N | S | F | D | V | W | 1 |
| C | A | R | L | I | E | V | H | P | S | F | D | Q | M | D | V | W | 1 |
| C | A | R | R | K | P | M | F | L | K | K | A | V | F | D | V | W | 1 |
| C | A | R | R | K | F | H | R | Y | S | T | V | K | F | D | Y | W | 2 |
| C | A | R | R | K | T | M | R | S | R | V | K | Y | F | D | Y | W | 1 |
| C | A | R | K | K | R | S | W | R | R | M | D | R | F | D | V | W | 1 |
| C | A | R | R | N | P | R | R | G | R | M | N | R | F | D | V | W | 1 |
| C | A | R | K | G | K | K | K | F | A | R | P | R | F | D | V | W | 1 |
| C | A | R | R | M | V | H | K | G | K | R | K | I | F | D | V | W | 1 |
| C | A | R | R | K | H | I | T | Y | P | R | K | Q | F | D | V | W | 1 |
| C | A | R | R | W | T | K | R | R | S | F | A | R | F | D | V | W | 1 |
| C | A | R | K | K | L | K | Q | Y | T | F | S | R | F | D | Y | W | 1 |

Figure 16: Purification of fluorescein binding scFv fragments

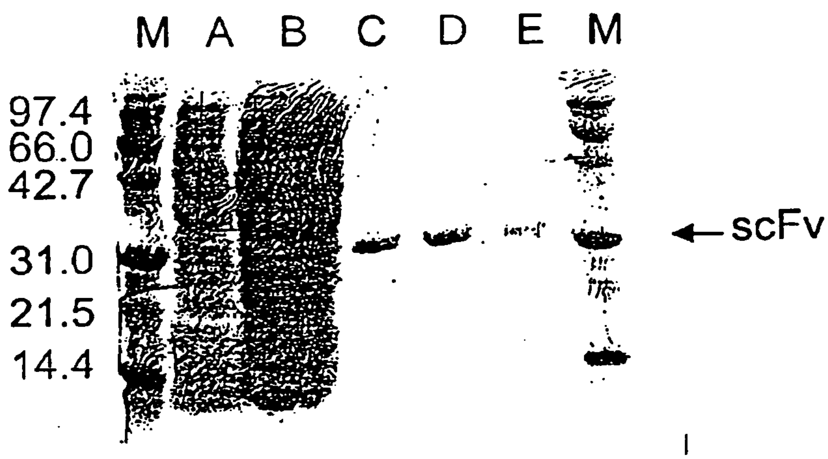


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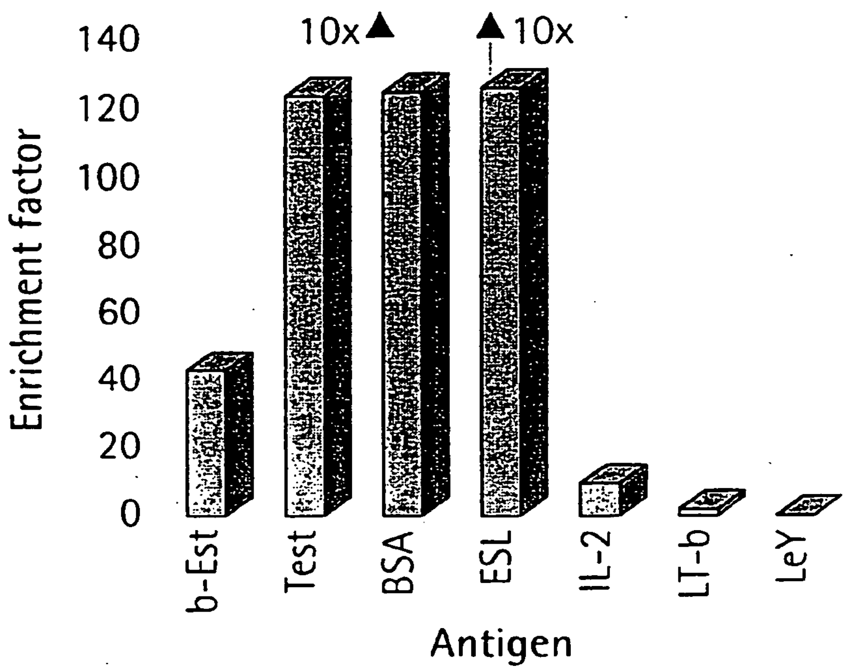
Figure 17: Enrichment factors after three rounds of panning



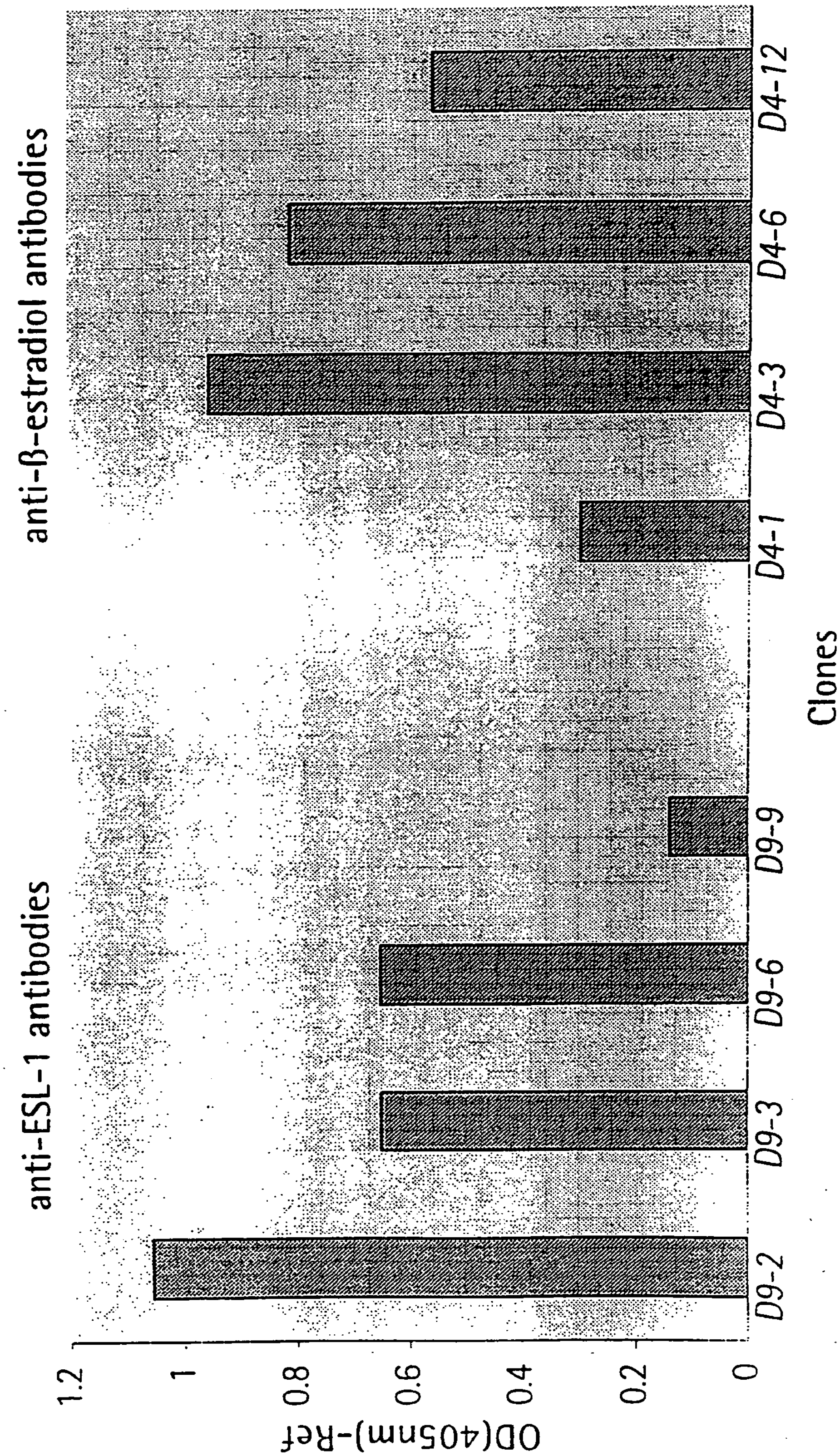



Figure 18: ELISA of anti-ESL-1 and anti-β-estradiol antibodies

Figure 19: Selectivity and cross-reactivity of HuCAL antibodies

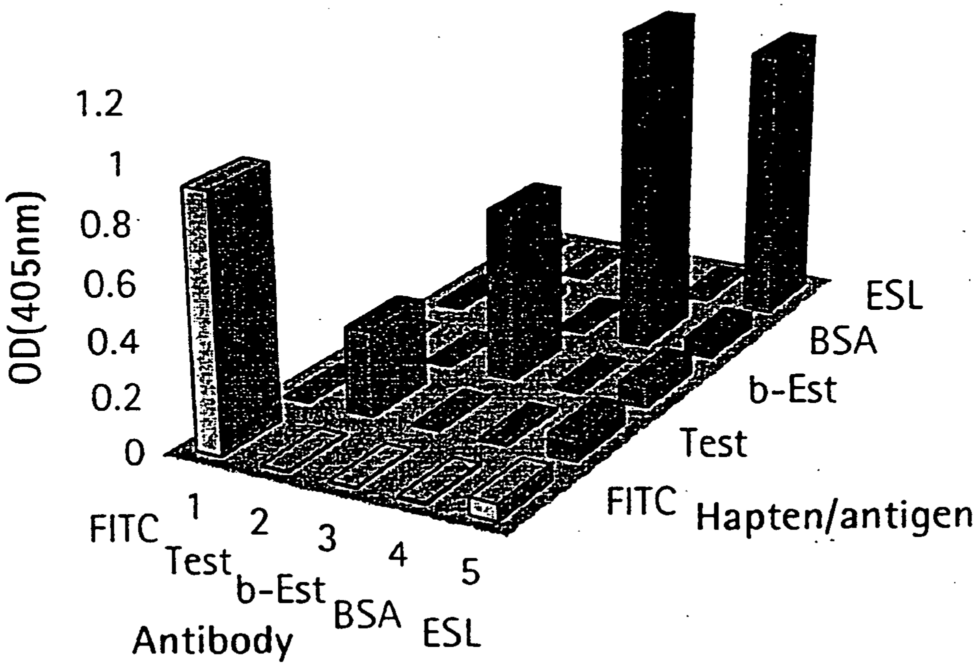


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Figure 20: Sequence analysis of estradiol binders

| 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 100A | 100B | 100C | 100D | 100E | 101 | 102 | 103 | Frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | A | R | T | R | P | W | Q | A | T | R | K | G | F | D | V | W | 3 |
| C | A | R | N | Q | W | E | F | K | N | R | R | K | M | D | Y | W | 8 |
| C | A | R | K | R | W | M | W | P | I | G | K | R | F | D | Y | W | 7 |
| C | A | R | Y | S | L | W | R | L | D | E | Y | F | F | D | Y | W | 1 |
| C | A | R | V | P | W | G | D | F | W | S | W | H | M | D | V | W | 1 |
| C | A | R | N | G | L | E | P | R | H | R | K | M | M | D | Y | W | 1 |
| C | A | R | I | M | K | A | P | P | - | - | - | - | - | D | Y | W | 1 |
| C | A | R | R | K | T | W | H | W | F | Y | K | R | M | D | Y | W | 1 |
| C | A | R | W | K | D | M | W | S | Q | V | Y | V | M | D | Y | W | 1 |
| C | A | R | N | K | Q | Q | M | R | F | R | R | F | M | D | Y | W | 5 |
| C | A | R | N | M | L | A | L | S | R | G | K | E | M | D | V | W | 4 |
| C | A | R | N | M | R | L | M | R | M | R | K | N | F | D | V | W | 1 |

00421064 - 09006400

Figure 21: Sequence analysis of testosterone binders

| 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 100A | 100B | 100C | 100D | 100E | 101 | 102 | 103 | Frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | A | R | Y | I | K | Q | A | K | R | K | L | A | F | D | Y | W | 4 |
| C | A | R | Y | N | R | H | A | W | Q | K | M | Q | F | D | Y | W | 3 |
| C | A | R | Y | V | K | Y | A | R | N | K | M | Q | F | D | Y | W | 2 |
| C | A | R | Y | K | R | G | A | W | M | K | T | M | F | D | V | W | 1 |
| C | A | R | R | K | P | L | R | R | I | M | K | W | F | D | Y | W | 1 |
| C | A | R | Y | R | K | R | A | S | R | Q | M | Q | F | D | Y | W | 1 |

Figure 22: Sequence analysis of lymphotoxin-ß binders

| 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 100A | 100B | 100C | 100D | 100E | 101 | 102 | 103 | Frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | A | R | Q | R | Y | R | S | K | I | K | G | H | F | D | V | W | 16 |
| C | A | R | _ | W | R | D | F | N | S | Y | D | P | M | D | Y | W | 1 |
| C | A | R | M | A | D | L | D | N | Y | W | V | Q | F | D | Y | W | 1 |
| C | A | R | L | Q | A | Y | L | K | P | H | H | W | M | D | Y | W | 1 |
| C | A | R | R | L | I | E | Q | A | R | D | H | V | M | D | Y | W | 1 |
| C | A | R | S | W | H | N | S | Q | F | T | Q | S | F | D | V | W | 1 |
| C | A | R | V | D | H | F | Q | T | E | N | E | W | M | D | Y | W | 1 |
| C | A | R | D | W | P | T | L | I | F | W | Y | W | F | D | Y | W | 1 |



00420.49006960

Figure 23: Sequence analysis of ESL-1 binders

| 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 100A | 100B | 100C | 100Ca | 100D | 100E | 101 | 102 | 103 | Frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | A | R | G | F | G | F | T | E | - | - | - | - | - | - | D | Y | W | 4 |
| C | A | R | Q | F | D | E | D | S | F | V | R | - | R | F | D | V | W | 4 |
| C | A | R | I | L | K | E | S | S | K | S | R | - | Q | M | D | V | W | 2 |
| C | A | R | E | Q | D | E | Y | G | A | I | R | - | I | M | D | Y | W | 1 |
| C | A | R | N | H | F | E | A | S | W | P | R | R | Q | M | D | V | W | 1 |
| C | A | R | E | N | E | W | V | D | M | I | L | - | D | M | D | Y | W | 2 |
| C | A | R | Q | Y | S | E | T | R | W | V | R | - | K | F | D | Y | W | 1 |
| C | A | R | Q | F | K | E | S | K | T | R | R | - | K | F | D | V | W | 13 |
| C | A | R | K | K | T | Q | Y | V | H | D | W | - | R | M | D | V | W | 3 |
| C | A | R | R | W | R | E | T | K | S | K | R | - | F | F | D | V | W | 1 |
| C | A | R | D | Y | I | M | E | F | - | - | - | - | - | - | D | Y | W | 1 |
| C | A | R | Q | F | E | E | T | K | Q | R | R | - | L | M | D | Y | W | 1 |

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Figure 24: Sequence analysis of BSA binders

| 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 100A | 100B | 100C | 100D | 100E | 101 | 102 | 103 | Frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | A | R | D | Q | G | F | Y | A | I | D | Y | V | M | D | Y | W | 5 |
| C | A | R | V | F | T | Y | M | Y | N | Y | F | R | F | D | V | W | 1 |
| C | A | R | V | F | F | E | Q | M | E | V | V | R | M | D | V | W | 1 |
| C | A | R | E | K | E | Y | R | L | S | W | S | Q | M | D | Y | W | 1 |
| C | A | R | Y | P | S | R | W | A | P | N | W | Y | M | D | Y | W | 1 |
| C | A | R | D | G | G | F | K | P | L | T | H | F | F | D | V | W | 1 |

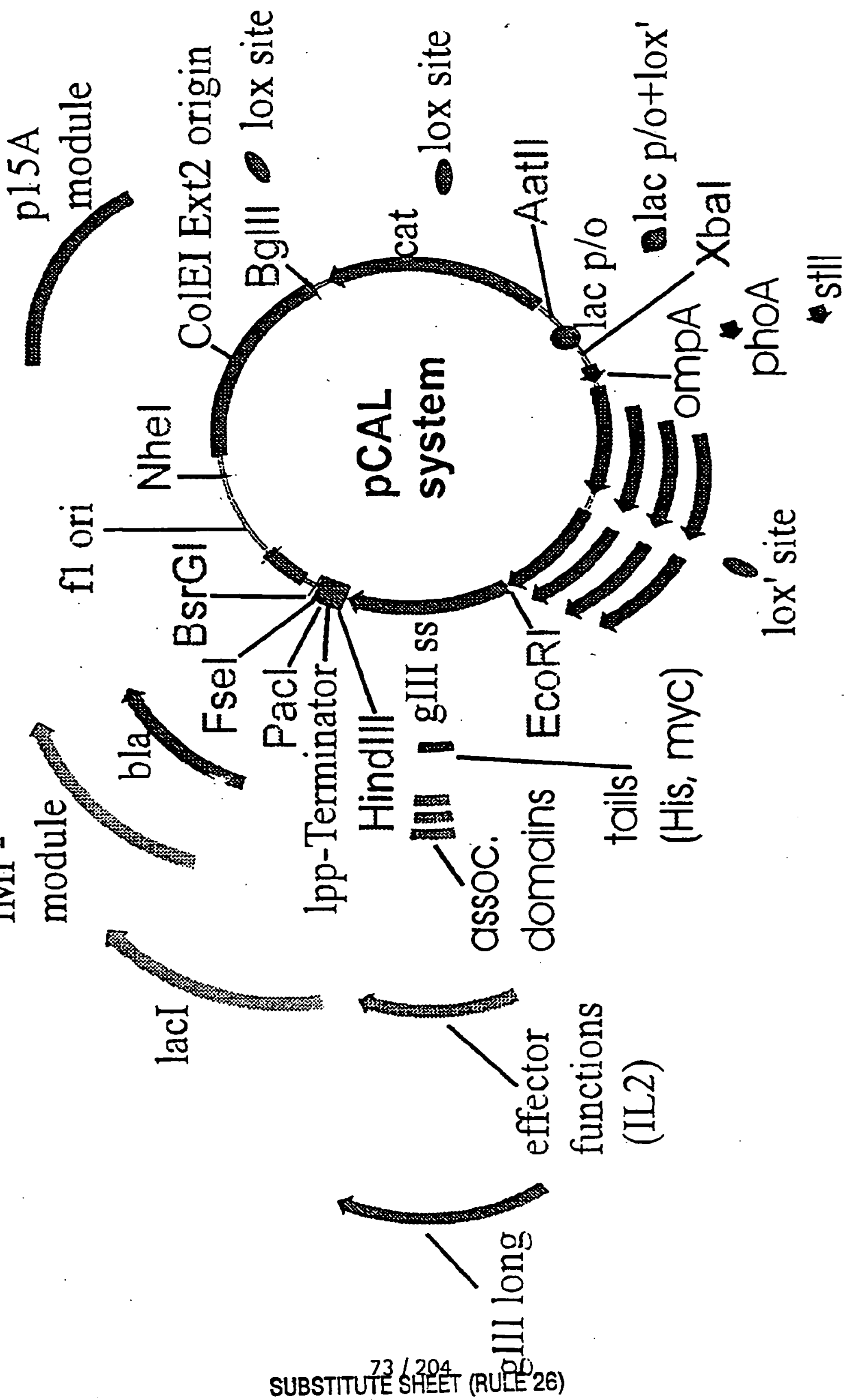


Figure 25: modular pCAL vector system

Figure 25a: List of unique restriction sites used in or suitable for HuCAL genes or pCAL vectors

| unique restriction site | Isoschizomers |
|---|---|
| AatII | / |
| AflII | BfrI, BspTI, Bst98I |
| AscI | / |
| AseI | VspI, AsnI, PshBI |
| BamHI | BstI |
| BbeI | EheI, KasI, NarI |
| BbsI | BpuAI, BpiI |
| BglII | / |
| BlpI | Bpu1102I,CelII, BlpI |
| BsaBI | MamI, Bsh1365I, BsrBRI |
| BsiWI | Pfl23II, SplI, SunI |
| BspEI | AccIII, BseAI, BsiMI, Kpn2I, MroI |
| BsrGI | Bsp1407I, SspBI |
| BssHII | PauI |
| BstEII | BstPI, Eco91I, EcoO651 |
| BstXI | / |
| Bsu36I | AocI, CvnI, Eco81I |
| DraIII | / |
| DsmAI | |
| EagI | BstZI, EclXI, Eco52I, XmaIII |
| Eco57I | / |
| EcoO109I | DraII |
| EcoRI | / |
| EcoRV | Eco32I |
| FseI | / |
| HindIII | / |
| HpaI | / |
| KpnI | Acc65I, Asp718I |
| MluI | / |
| MscI | BalI, MluNI |

Figure 25a: List of unique restriction sites used in or suitable for HuCAL genes or pCAL vectors

| unique restriction site | Isoschizomers |
|---|---|
| MunI | MfeI |
| NheI | / |
| NsiI | Ppu10I, EcoT22I, Mph1103I |
| NspV | Bsp119I, BstBI, Csp45I, LspI, SfuI |
| PacI | / |
| PmeI | / |
| PmlI | BbrPI, Eco72I, PmaCI |
| Psp5II | PpuMI |
| PstI | / |
| RsrII | (RsriI), CpoI, CspI |
| SanDI | / |
| SapI | / |
| SexAI | / |
| SpeI | / |
| SfiI | / |
| SphI | BbuI, PaeI,NspI |
| StuI | AatI, Eco147I |
| StyI | Eco130I, EcoT14I |
| XbaI | BspLU11II |
| XhoI | PaeR7I |
| XmaI | AvaI, SmaI, Cfr9I, PspAI |

Figure26: list of pCAL vector modules

| No | module/flanking restriction sites | functional element | sites to be removed | sites to be inserted | template | reference |
|---|---|---|---|---|---|---|
| M1 | AatII-lacp/o-XbaI | lac promotor/operator | 2x VspI (AseI) | AatII | vector pASK30 | Skerra et al. (1991) Bio/Technology 9, 273-278 |
| M2 | BglII-lox-AatII | Cre/lox recombination site | 2x VspI (AseI) | lox, BglII | (synthetic) | Hoess et al. (1986) Nucleic Acids Res. 2287-2300 |
| M3 | XbaI-lox'-SphI | Cre/lox' recombination site | none | lox', SphI | (synthetic) | see M2 |
| M7-I | EcoRI-gIIIlong-HindIII | gIIIp of filamentous phage with N-terminal myctail/amber codon | SphI, BamHI | none | vector pIG10 | Ge et al., (1994) Expressing antibodies in E. coli. In: Antibody engineering: A practical approach. IRL Press, New York, pp 229-266 |

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Figure26: list of pCAL vector modules

| | | | | | | |
|---|---|---|---|---|---|---|
| M7-II | EcoRI-gIIIss-HindIII | truncated gIIIp of filamentous phage with N-terminal Gly-Ser linker | SphI | | vector pIG10 | see M7-I |
| M7-III | EcoRI-gIIIss-HindIII | truncated gIIIp of filamentous phage with N-terminal myctail/amber codon | SphI, BbsI | | vector pIG10 | see M7-I |
| M8 | SphI-lox-HindIII | Cre/lox recombination site | none | lox | (synthetic) | see M3 |
| M9-II | HindIII-lpp-PacI | lpp-terminator | none | PacI, FseI | (synthetic) | see M1 |
| M10-II | PacI/FseI-bla-BsrGI | beta-lactamase/bla (ampR) | VspI, Eco57I, BssSI | PacI, FseI, BsrGI | pASK30 | see M1 |
| M11-II | BsrGI-f1 ori-NheI | origin of single-stranded replication | DraIII (BanII not removed) | BsrGI, NheI | pASK30 | see M1 |
| M11-III | BsrGI-f1 ori-NheI | origin of single-stranded replication | DraIII, BanII | BsrGI, NheI | pASK30 | see M1 |

Figure26: list of pCAL vector modules

| | | | | | | |
|---|---|---|---|---|---|---|
| M12 | NheI-p15A-BglII | origin of double-stranded replication | BssSI, VspI, NspV | NheI, BglII | pACYC184 | Rose, R.E. (1988) Nucleic Acids Res. 16, 355 |
| M13 | BglII-lox-BglII | Cre/lox recombination site | none | BglII, lox, XmnI | (synthetic) | see M3 |
| M14-Ext2 | BglII-ColEI-NheI | origin of double-stranded replication | Eco57I (BssSI not removed) | BglII, NheI | pUC19 | Yanisch-Peron, C. (1985) Gene 33,103-119 |
| M17 | AatII-cat-BglII | chloramphenicol-acetyltransferase/ cat (camR) | BspEI, MscI, StyI/NcoI | | pACYC184 | Cardoso, M. & Schwarz,S. (1992) J. Appl. Bacteriol.72, 289-293 |
| M19 | XbaI-phoA-EcoRI | signal sequence of phosphatase A | (synthetic) | | (synthetic) | see M1 |
| M20 | XbaI-phoA-FLAG-EcoRI | signal sequence of phosphatase A + FLAG detection tag | (synthetic) | | (synthetic) | Knappik, A & Plückthun, A. (1994) BioTechniques 17, 754-761 |

Figure26: list of pCAL vector modules

| | | | | | | |
|---|---|---|---|---|---|---|
| M21 | Xbal-stII-Sapl | heat-stable enterotoxin II signal sequence | (synthetic) | | (synthetic) | Lee et al. (1983) Infect. Immunol. 264-268 |
| M41 | AflII-lacI-Nhel | lac-repressor | BstXI, MluI,BbsI, BanII, BstEII, HpaI, BbeI, VspI | | pASK30 | see M1 |
| M42 | EcoRI-Histail-HindIII | poly-histidine tail | (synthetic) | | (synthetic) | Lindner et al., (1992) Methods: a companion to methods in enzymology 4, 41-56 |

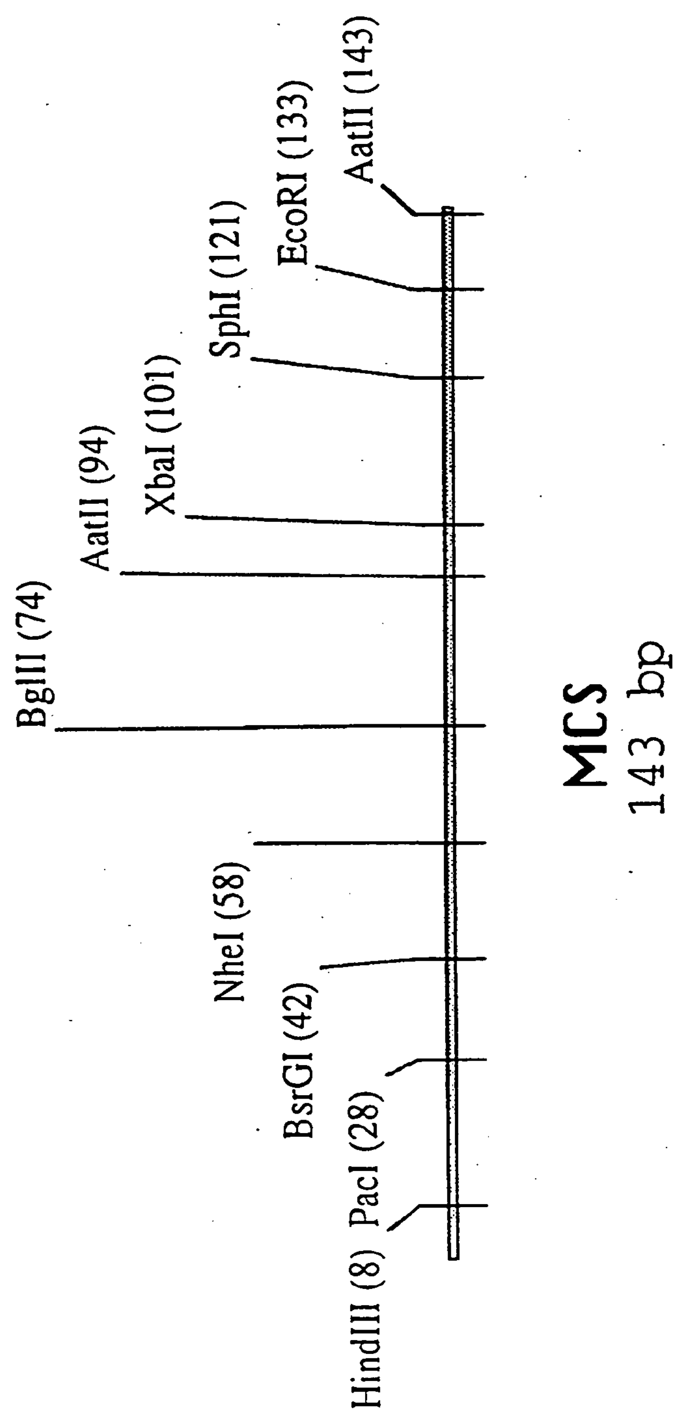


Figure 27: functional map and sequence of MCS module

Figure 27: functional map and sequence of MCS module (continued)

```
              HindIII                 PacI                      BsrGI
             ~~~~~~~~              ~~~~~~~~~                   ~~~~~~~
  1   ACATGTAAGC TTCCCCCCCC CCTTAATTAA CCCCCCCCCC TGTACACCCC
      TGTACATTCG AAGGGGGGGG GGAATTAATT GGGGGGGGGG ACATGTGGGG

               NheI                  BglII                AatII    XbaI
             ~~~~~~~~              ~~~~~~~              ~~~~~~~~      ~
 51   CCCCCCGCTA GCCCCCCCCC CCAGATCTCC CCCCCCCCGA CGTCCCCCCT
      GGGGGGCGAT CGGGGGGGGG GGTCTAGAGG GGGGGGGGCT GCAGGGGGGA

      XbaI                SphI                    EcoRI AatII
      ~~~~~             ~~~~~~~~               ~~~~~~~~~~~~~~
101   CTAGACCCCC CCCCCGCATG CCCCCCCCCC CGAATTCGAC GTC
      GATCTGGGGG GGGGGCGTAC GGGGGGGGGG GCTTAAGCTG CAG
```

Figure 28: functional map and sequence of pMCS cloning vector

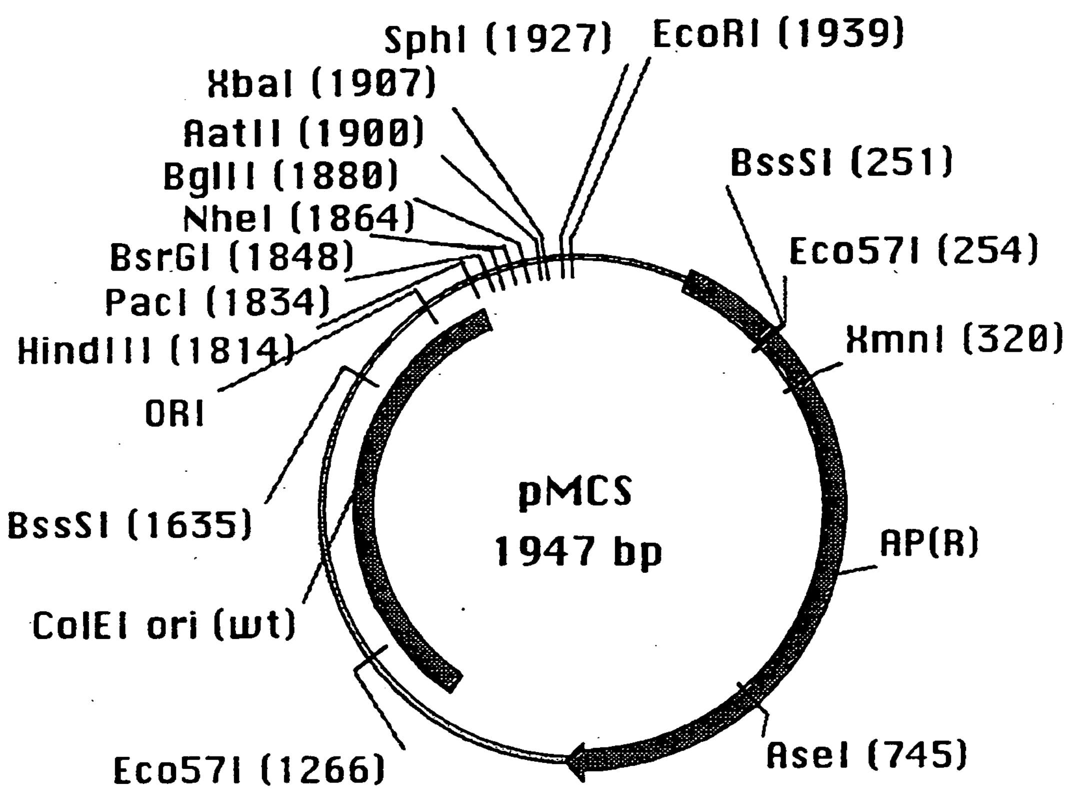

Figure 28: functional map and sequence of pMCS cloning vector (continued)

```
  1   CAGGTGGCAC TTTTCGGGGA AATGTGCGCG GAACCCCTAT TTGTTTATTT
      GTCCACCGTG AAAAGCCCCT TTACACGCGC CTTGGGGATA AACAAATAAA

 51   TTCTAAATAC ATTCAAATAT GTATCCGCTC ATGAGACAAT AACCCTGATA
      AAGATTTATG TAAGTTTATA CATAGGCGAG TACTCTGTTA TTGGGACTAT

101   AATGCTTCAA TAATATTGAA AAAGGAAGAG TATGAGTATT CAACATTTCC
      TTACGAAGTT ATTATAACTT TTTCCTTCTC ATACTCATAA GTTGTAAAGG

151   GTGTCGCCCT TATTCCCTTT TTTGCGGCAT TTTGCCTTCC TGTTTTTGCT
      CACAGCGGGA ATAAGGGAAA AAACGCCGTA AAACGGAAGG ACAAAAACGA

                                       Eco57I
                                       ~~~~~~
201   CACCCAGAAA CGCTGGTGAA AGTAAAAGAT GCTGAAGATC AGTTGGGTGC
      GTGGGTCTTT GCGACCACTT TCATTTTCTA CGACTTCTAG TCAACCCACG
                                                      BssSI
                                                          ~

251   ACGAGTGGGT TACATCGAAC TGGATCTCAA CAGCGGTAAG ATCCTTGAGA
      TGCTCACCCA ATGTAGCTTG ACCTAGAGTT GTCGCCATTC TAGGAACTCT
     BssSI
     ~~~~~
```

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Figure 28: functional map and sequence of pMCS cloning vector (continued)

```
                                 XmnI
                             ~~~~~~~~~~~~
301  GTTTTCGCCC CGAAGAACGT TTTCCAATGA TGAGCACTTT TAAAGTTCTG
     CAAAAGCGGG GCTTCTTGCA AAAGGTTACT ACTCGTGAAA ATTTCAAGAC

351  CTATGTGGCG CGGTATTATC CCGTATTGAC GCCGGGCAAG AGCAACTCGG
     GATACACCGC GCCATAATAG GGCATAACTG CGGCCCGTTC TCGTTGAGCC

401  TCGCCGCATA CACTATTCTC AGAATGACTT GGTTGAGTAC TCACCAGTCA
     AGCGGCGTAT GTGATAAGAG TCTTACTGAA CCAACTCATG AGTGGTCAGT

451  CAGAAAAGCA TCTTACGGAT GGCATGACAG TAAGAGAATT ATGCAGTGCT
     GTCTTTTCGT AGAATGCCTA CCGTACTGTC ATTCTCTTAA TACGTCACGA

501  GCCATAACCA TGAGTGATAA CACTGCGGCC AACTTACTTC TGACAACGAT
     CGGTATTGGT ACTCACTATT GTGACGCCGG TTGAATGAAG ACTGTTGCTA

551  CGGAGGACCG AAGGAGCTAA CCGCTTTTTT GCACAACATG GGGGATCATG
     GCCTCCTGGC TTCCTCGATT GGCGAAAAAA CGTGTTGTAC CCCCTAGTAC

601  TAACTCGCCT TGATCGTTGG GAACCGGAGC TGAATGAAGC CATACCAAAC
     ATTGAGCGGA ACTAGCAACC CTTGGCCTCG ACTTACTTCG GTATGGTTTG

651  GACGAGCGTG ACACCACGAT GCCTGTAGCA ATGGCAACAA CGTTGCGCAA
```

00h2T0" h9006h60

Figure 28: functional map and sequence of pMCS cloning vector (continued)

```
      CTGCTCGCAC TGTGGTGCTA CGGACATCGT TACCGTTGTT GCAACGCGTT

                                                    AseI
                                                   ~~~~~~
 701  ACTATTAACT GGCGAACTAC TTACTCTAGC TTCCCGGCAA CAATTAATAG
      TGATAATTGA CCGCTTGATG AATGAGATCG AAGGGCCGTT GTTAATTATC

 751  ACTGGATGGA GGCGGATAAA GTTGCAGGAC CACTTCTGCG CTCGGCCCTT
      TGACCTACCT CCGCCTATTT CAACGTCCTG GTGAAGACGC GAGCCGGGAA

 801  CCGGCTGGCT GGTTTATTGC TGATAAATCT GGAGCCGGTG AGCGTGGGTC
      GGCCGACCGA CCAAATAACG ACTATTTAGA CCTCGGCCAC TCGCACCCAG

 851  TCGCGGTATC ATTGCAGCAC TGGGGCCAGA TGGTAAGCCC TCCCGTATCG
      AGCGCCATAG TAACGTCGTG ACCCCGGTCT ACCATTCGGG AGGGCATAGC

 901  TAGTTATCTA CACGACGGGG AGTCAGGCAA CTATGGATGA ACGAAATAGA
      ATCAATAGAT GTGCTGCCCC TCAGTCCGTT GATACCTACT TGCTTTATCT

 951  CAGATCGCTG AGATAGGTGC CTCACTGATT AAGCATTGGT AACTGTCAGA
      GTCTAGCGAC TCTATCCACG GAGTGACTAA TTCGTAACCA TTGACAGTCT

1001  CCAAGTTTAC TCATATATAC TTTAGATTGA TTTAAAACTT CATTTTTAAT
      GGTTCAAATG AGTATATATG AAATCTAACT AAATTTTGAA GTAAAAATTA
```

00h2T0" h9006h60

Figure 28: functional map and sequence of pMCS cloning vector (continued)

```
1051  TTAAAAGGAT CTAGGTGAAG ATCCTTTTTG ATAATCTCAT GACCAAAATC
      AATTTTCCTA GATCCACTTC TAGGAAAAAC TATTAGAGTA CTGGTTTTAG

1101  CCTTAACGTG AGTTTTCGTT CCACTGAGCG TCAGACCCCG TAGAAAAGAT
      GGAATTGCAC TCAAAAGCAA GGTGACTCGC AGTCTGGGGC ATCTTTTCTA

1151  CAAAGGATCT TCTTGAGATC CTTTTTTTCT GCGCGTAATC TGCTGCTTGC
      GTTTCCTAGA AGAACTCTAG GAAAAAAAGA CGCGCATTAG ACGACGAACG

1201  AAACAAAAAA ACCACCGCTA CCAGCGGTGG TTTGTTTGCC GGATCAAGAG
      TTTGTTTTTT TGGTGGCGAT GGTCGCCACC AAACAAACGG CCTAGTTCTC

1251  CTACCAACTC TTTTTCCGAA GGTAACTGGC TTCAGCAGAG CGCAGATACC
      GATGGTTGAG AAAAAGGCTT CCATTGACCG AAGTCGTCTC GCGTCTATGG
                                         Eco57I
                                         ~~~~~~~

1301  AAATACTGTC CTTCTAGTGT AGCCGTAGTT AGGCCACCAC TTCAAGAACT
      TTTATGACAG GAAGATCACA TCGGCATCAA TCCGGTGGTG AAGTTCTTGA

1351  CTGTAGCACC GCCTACATAC CTCGCTCTGC TAATCCTGTT ACCAGTGGCT
      GACATCGTGG CGGATGTATG GAGCGAGACG ATTAGGACAA TGGTCACCGA
```

Figure 28: functional map and sequence of pMCS cloning vector (continued)

```
1401   GCTGCCAGTG GCGATAAGTC GTGTCTTACC GGGTTGGACT CAAGACGATA
       CGACGGTCAC CGCTATTCAG CACAGAATGG CCCAACCTGA GTTCTGCTAT

1451   GTTACCGGAT AAGGCGCAGC GGTCGGGCTG AACGGGGGGT TCGTGCACAC
       CAATGGCCTA TTCCGCGTCG CCAGCCCGAC TTGCCCCCCA AGCACGTGTG

1501   AGCCCAGCTT GGAGCGAACG ACCTACACCG AACTGAGATA CCTACAGCGT
       TCGGGTCGAA CCTCGCTTGC TGGATGTGGC TTGACTCTAT GGATGTCGCA

1551   GAGCTATGAG AAAGCGCCAC GCTTCCCGAA GGGAGAAAGG CGGACAGGTA
       CTCGATACTC TTTCGCGGTG CGAAGGGCTT CCCTCTTTCC GCCTGTCCAT

1601   TCCGGTAAGC GGCAGGGTCG GAACAGGAGA GCGCACGAGG GAGCTTCCAG
       AGGCCATTCG CCGTCCCAGC CTTGTCCTCT CGCGTGCTCC CTCGAAGGTC
                                              BssSI
                                             ~~~~~~~

1651   GGGGAAACGC CTGGTATCTT TATAGTCCTG TCGGGTTTCG CCACCTCTGA
       CCCCTTTGCG GACCATAGAA ATATCAGGAC AGCCCAAAGC GGTGGAGACT

1701   CTTGAGCGTC GATTTTTGTG ATGCTCGTCA GGGGGGCGGA GCCTATGGAA
       GAACTCGCAG CTAAAAACAC TACGAGCAGT CCCCCCGCCT CGGATACCTT

1751   AAACGCCAGC AACGCGGCCT TTTTACGGTT CCTGGCCTTT TGCTGGCCTT
```

Figure 28: functional map and sequence of pMCS cloning vector (continued)

```
        TTTGCGGTCG TTGCGCCGGA AAAATGCCAA GGACCGGAAA ACGACCGGAA

                      HindIII                PacI             BsrGI
                      ~~~~~~             ~~~~~~~~~~            ~~~~
1801    TTGCTCACAT GTAAGCTTCC CCCCCCCCTT AATTAACCCC CCCCCCTGTA
        AACGAGTGTA CATTCGAAGG GGGGGGGGAA TTAATTGGGG GGGGGGACAT

        BsrGI          NheI                 BglII             AatII
        ~~            ~~~~~~             ~~~~~~~~           ~~~~~~
1851    CACCCCCCCC CCGCTAGCCC CCCCCCCCAG ATCTCCCCCC CCCCGACGTC
        GTGGGGGGGG GGCGATCGGG GGGGGGGGTC TAGAGGGGGG GGGGCTGCAG

              XbaI                SphI                EcoRI
            ~~~~~~~~            ~~~~~~~             ~~~~~~~~
1901    CCCCCTCTAG ACCCCCCCCC CGCATGCCCC CCCCCCCGAA TTCACGT
        GGGGGAGATC TGGGGGGGGG GCGTACGGGG GGGGGGGCTT AAGTGCA
```

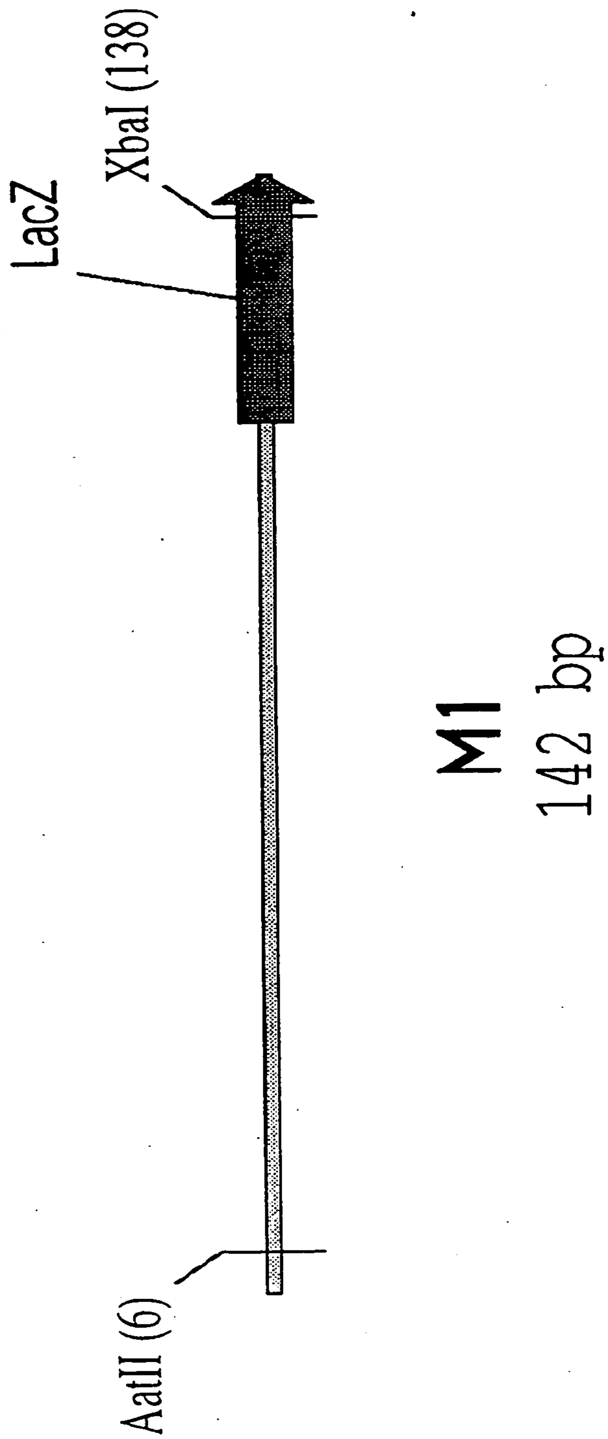



Figure 29: functional map and sequence of pCAL module M1

09906419.012400

Figure 29: functional map and sequence of pCAL module M1

```
        AatII
        ~~~~~~
  1     GACGTCTTAA TGTGAGTTAG CTCACTCATT AGGCACCCCA GGCTTTACAC
        CTGCAGAATT ACACTCAATC GAGTGAGTAA TCCGTGGGGT CCGAAATGTG

 51     TTTATGCTTC CGGCTCGTAT GTTGTGTGGA ATTGTGAGCG GATAACAATT
        AAATACGAAG GCCGAGCATA CAACACACCT TAACACTCGC CTATTGTTAA

                                                XbaI
                                               ~~~~~~
101     TCACACAGGA AACAGCTATG ACCATGATTA CGAATTTCTA GA
        AGTGTGTCCT TTGTCGATAC TGGTACTAAT GCTTAAAGAT CT
```

Figure 30: functional map and sequence of pCAL module M7-II

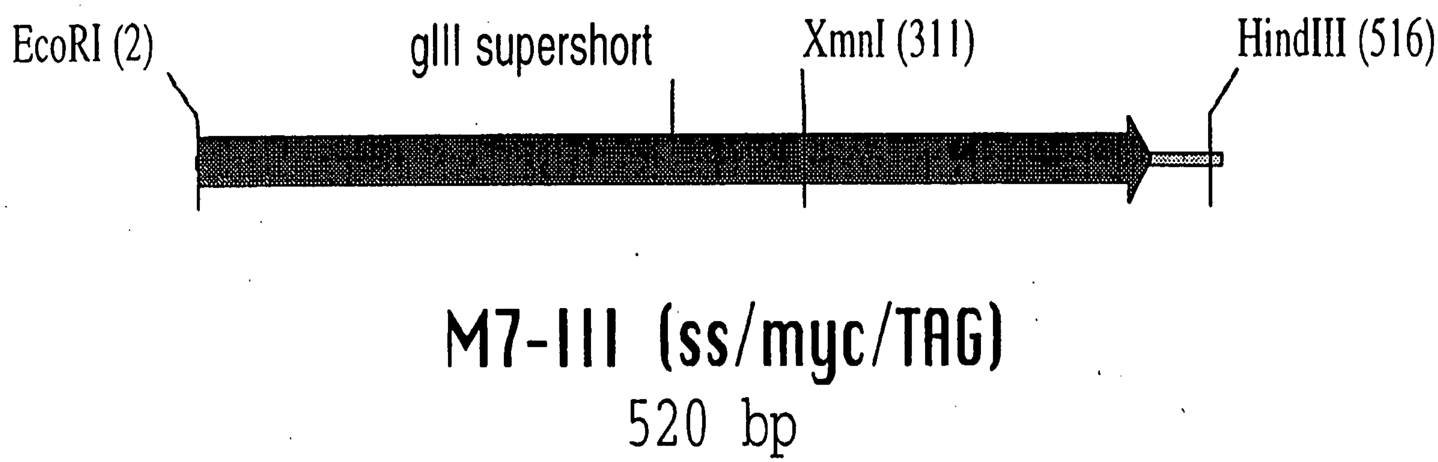


Figure 30: functional map and sequence of pCAL module M7-II (continued)

```
        EcoRI
       ~~~~~~~
  1    GAATTCGAGC AGAAGCTGAT CTCTGAGGAG GATCTGTAGG GTGGTGGCTC
       CTTAAGCTCG TCTTCGACTA GAGACTCCTC CTAGACATCC CACCACCGAG

 51    TGGTTCCGGT GATTTTGATT ATGAAAAGAT GGCAAACGCT AATAAGGGGG
       ACCAAGGCCA CTAAAACTAA TACTTTTCTA CCGTTTGCGA TTATTCCCCC

101    CTATGACCGA AAATGCCGAT GAAAACGCGC TACAGTCTGA CGCTAAAGGC
       GATACTGGCT TTTACGGCTA CTTTTGCGCG ATGTCAGACT GCGATTTCCG

151    AAACTTGATT CTGTCGCTAC TGATTACGGT GCTGCTATCG ATGGTTTCAT
       TTTGAACTAA GACAGCGATG ACTAATGCCA CGACGATAGC TACCAAAGTA

201    TGGTGACGTT TCCGGCCTTG CTAATGGTAA TGGTGCTACT GGTGATTTTG
       ACCACTGCAA AGGCCGGAAC GATTACCATT ACCACGATGA CCACTAAAAC

251    CTGGCTCTAA TTCCCAAATG GCTCAAGTCG GTGACGGTGA TAATTCACCT
       GACCGAGATT AAGGGTTTAC CGAGTTCAGC CACTGCCACT ATTAAGTGGA

                 XmnI
             ~~~~~~~~~~~~
301    TTAATGAATA ATTTCCGTCA ATATTTACCT TCCCTCCCTC AATCGGTTGA
       AATTACTTAT TAAAGGCAGT TATAAATGGA AGGGAGGGAG TTAGCCAACT
```

Figure 30: functional map and sequence of pCAL module M7-II (continued)

```
351   ATGTCGCCCT TTTGTCTTTG GCGCTGGTAA ACCATATGAA TTTTCTATTG
      TACAGCGGGA AAACAGAAAC CGCGACCATT TGGTATACTT AAAAGATAAC

401   ATTGTGACAA AATAAACTTA TTCCGTGGTG TCTTTGCGTT TCTTTTATAT
      TAACACTGTT TTATTTGAAT AAGGCACCAC AGAAACGCAA AGAAAATATA

451   GTTGCCACCT TTATGTATGT ATTTTCTACG TTTGCTAACA TACTGCGTAA
      CAACGGTGGA AATACATACA TAAAAGATGC AAACGATTGT ATGACGCATT

                           HindIII
                           ~~~~~~
501   TAAGGAGTCT TGATAAGCTT
      ATTCCTCAGA ACTATTCGAA
```

Figure 31: functional map and sequence of pCAL module M9-II

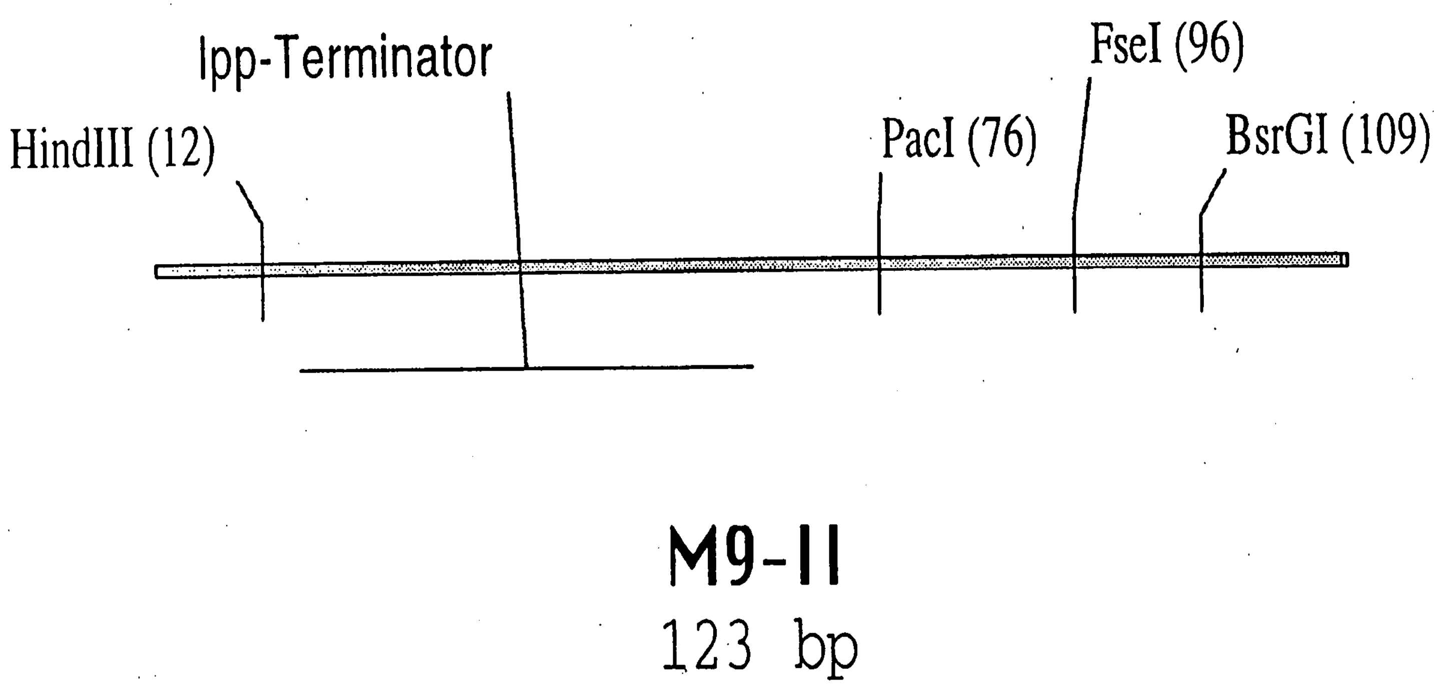


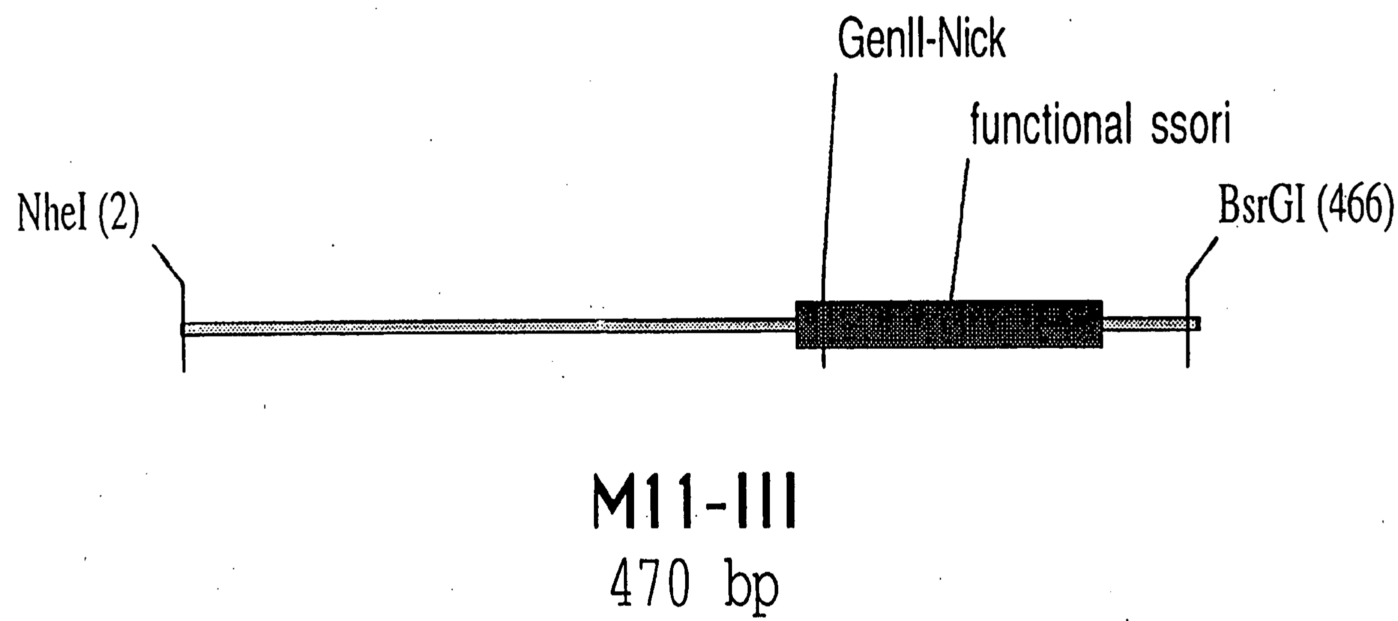
Figure 31: functional map and sequence of pCAL module M9-II (continued)

```
                HindIII
                ~~~~~~~
  1   GGGGGGGGGG AAGCTTGACC TGTGAAGTGA AAAATGGCGC AGATTGTGCG
      CCCCCCCCCC TTCGAACTGG ACACTTCACT TTTTACCGCG TCTAACACGC

                             PacI                FseI
                           ~~~~~~~~~         ~~~~~~~~~~
 51   ACATTTTTTT TGTCTGCCGT TTAATTAAAG GGGGGGGGGG GCCGGCCTGG
      TGTAAAAAAA ACAGACGGCA AATTAATTTC CCCCCCCCCC CGGCCGGACC

           BsrGI
         ~~~~~~~~
101   GGGGGGGTGT ACAGGGGGGG GGG
      CCCCCCCACA TGTCCCCCCC CCC
```

Figure 32: functional map and sequence of pCAL module M11-III



09009640 "012400

Figure 32: functional map and sequence of pCAL module M11-III (continued)

```
          NheI
          ~~~~~~~
  1   GCTAGCACGC  GCCCTGTAGC  GGCGCATTAA  GCGCGGCGGG  TGTGGTGGTT
      CGATCGTGCG  CGGGACATCG  CCGCGTAATT  CGCGCCGCCC  ACACCACCAA

 51   ACGCGCAGCG  TGACCGCTAC  ACTTGCCAGC  GCCCTAGCGC  CCGCTCCTTT
      TGCGCGTCGC  ACTGGCGATG  TGAACGGTCG  CGGGATCGCG  GGCGAGGAAA

101   CGCTTTCTTC  CCTTCCTTTC  TCGCCACGTT  CGCCGGCTTT  CCCCGTCAAG
      GCGAAAGAAG  GGAAGGAAAG  AGCGGTGCAA  GCGGCCGAAA  GGGGCAGTTC

151   CTCTAAATCG  GGGCATCCCT  TTAGGGTTCC  GATTTAGTGC  TTTACGGCAC
      GAGATTTAGC  CCCGTAGGGA  AATCCCAAGG  CTAAATCACG  AAATGCCGTG

201   CTCGACCCCA  AAAAACTTGA  TTAGGGTGAT  GGTTCTCGTA  GTGGGCCATC
      GAGCTGGGGT  TTTTTGAACT  AATCCCACTA  CCAAGAGCAT  CACCCGGTAG

251   GCCCTGATAG  ACGGTTTTTC  GCCCTTTGAC  GTTGGAGTCC  ACGTTCTTTA
      CGGGACTATC  TGCCAAAAAG  CGGGAAACTG  CAACCTCAGG  TGCAAGAAAT

301   ATAGTGGACT  CTTGTTCCAA  ACTGGAACAA  CACTCAACCC  TATCTCGGTC
      TATCACCTGA  GAACAAGGTT  TGACCTTGTT  GTGAGTTGGG  ATAGAGCCAG

351   TATTCTTTTG  ATTTATAAGG  GATTTTGCCG  ATTTCGGCCT  ATTGGTTAAA
```

00420 49006460

Figure 32: functional map and sequence of pCAL module M11-III (continued)

```
     ATAAGAAAAC TAAATATTCC CTAAAACGGC TAAAGCCGGA TAACCAATTT

401  AAATGAGCTG ATTTAACAAA AATTTAACGC GAATTTTAAC AAAATATTAA
     TTTACTCGAC TAAATTGTTT TTAAATTGCG CTTAAAATTG TTTTATAATT

                          BsrGI
                         ~~~~~~
451  CGTTTACAAT TTCATGTACA
     GCAAATGTTA AAGTACATGT
```

Figure 33: functional map and sequence of pCAL module M14-Ext2

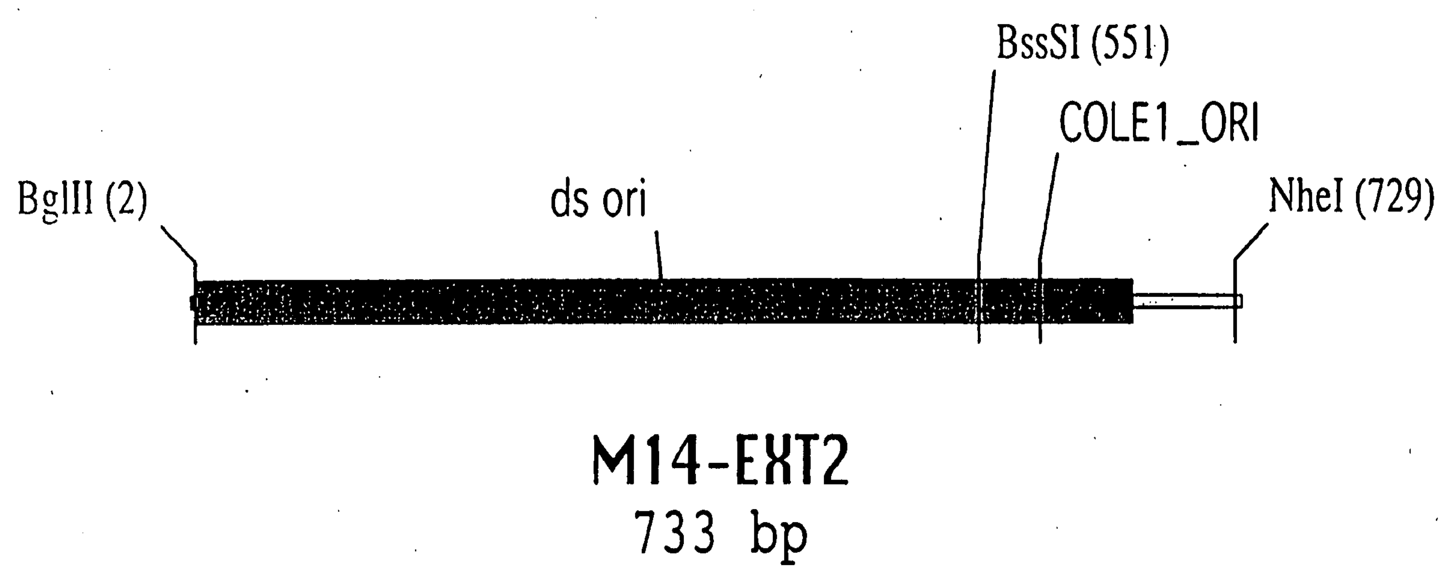


Figure 33: functional map and sequence of pCAL module M14-Ext2 (continued)

```
          BglII
          ~~~~~~
  1  AGATCTGACC AAAATCCCTT AACGTGAGTT TTCGTTCCAC TGAGCGTCAG
     TCTAGACTGG TTTTAGGGAA TTGCACTCAA AAGCAAGGTG ACTCGCAGTC

 51  ACCCCGTAGA AAAGATCAAA GGATCTTCTT GAGATCCTTT TTTTCTGCGC
     TGGGGCATCT TTTCTAGTTT CCTAGAAGAA CTCTAGGAAA AAAAGACGCG

101  GTAATCTGCT GCTTGCAAAC AAAAAAACCA CCGCTACCAG CGGTGGTTTG
     CATTAGACGA CGAACGTTTG TTTTTTTGGT GGCGATGGTC GCCACCAAAC

151  TTTGCCGGAT CAAGAGCTAC CAACTCTTTT TCCGAAGGTA ACTGGCTACA
     AAACGGCCTA GTTCTCGATG GTTGAGAAAA AGGCTTCCAT TGACCGATGT

201  GCAGAGCGCA GATACCAAAT ACTGTTCTTC TAGTGTAGCC GTAGTTAGGC
     CGTCTCGCGT CTATGGTTTA TGACAAGAAG ATCACATCGG CATCAATCCG

251  CACCACTTCA AGAACTCTGT AGCACCGCCT ACATACCTCG CTCTGCTAAT
     GTGGTGAAGT TCTTGAGACA TCGTGGCGGA TGTATGGAGC GAGACGATTA

301  CCTGTTACCA GTGGCTGCTG CCAGTGGCGA TAAGTCGTGT CTTACCGGGT
     GGACAATGGT CACCGACGAC GGTCACCGCT ATTCAGCACA GAATGGCCCA

351  TGGACTCAAG ACGATAGTTA CCGGATAAGG CGCAGCGGTC GGGCTGAACG
```

09006490 .012400

Figure 33: functional map and sequence of pCAL module M14-Ext2 (continued)

```
     ACCTGAGTTC TGCTATCAAT GGCCTATTCC GCGTCGCCAG CCCGACTTGC

401  GGGGGTTCGT GCACACAGCC CAGCTTGGAG CGAACGACCT ACACCGAACT
     CCCCCAAGCA CGTGTGTCGG GTCGAACCTC GCTTGCTGGA TGTGGCTTGA

451  GAGATACCTA CAGCGTGAGC TATGAGAAAG CGCCACGCTT CCCGAAGGGA
     CTCTATGGAT GTCGCACTCG ATACTCTTTC GCGGTGCGAA GGGCTTCCCT

501  GAAAGGCGGA CAGGTATCCG GTAAGCGGCA GGGTCGGAAC AGGAGAGCGC
     CTTTCCGCCT GTCCATAGGC CATTCGCCGT CCCAGCCTTG TCCTCTCGCG
                                                     BssSI
                                                         ~

551  ACGAGGGAGC TTCCAGGGGG AAACGCCTGG TATCTTTATA GTCCTGTCGG
     TGCTCCCTCG AAGGTCCCCC TTTGCGGACC ATAGAAATAT CAGGACAGCC
     BssSI
     ~~~~~

601  GTTTCGCCAC CTCTGACTTG AGCGTCGATT TTTGTGATGC TCGTCAGGGG
     CAAAGCGGTG GAGACTGAAC TCGCAGCTAA AAACACTACG AGCAGTCCCC

651  GGCGGAGCCT ATGGAAAAAC GCCAGCAACG CGGCCTTTTT ACGGTTCCTG
     CCGCCTCGGA TACCTTTTTG CGGTCGTTGC GCCGGAAAAA TGCCAAGGAC
```

00h2T0" h9006h60

Figure 33: functional map and sequence of pCAL module M14-Ext2 (continued)

```
                                           NheI
                                          ~~~~~~
701  GCCTTTTGCT GGCCTTTTGC TCACATGGCT AGC
     CGGAAAACGA CCGGAAAACG AGTGTACCGA TCG
```

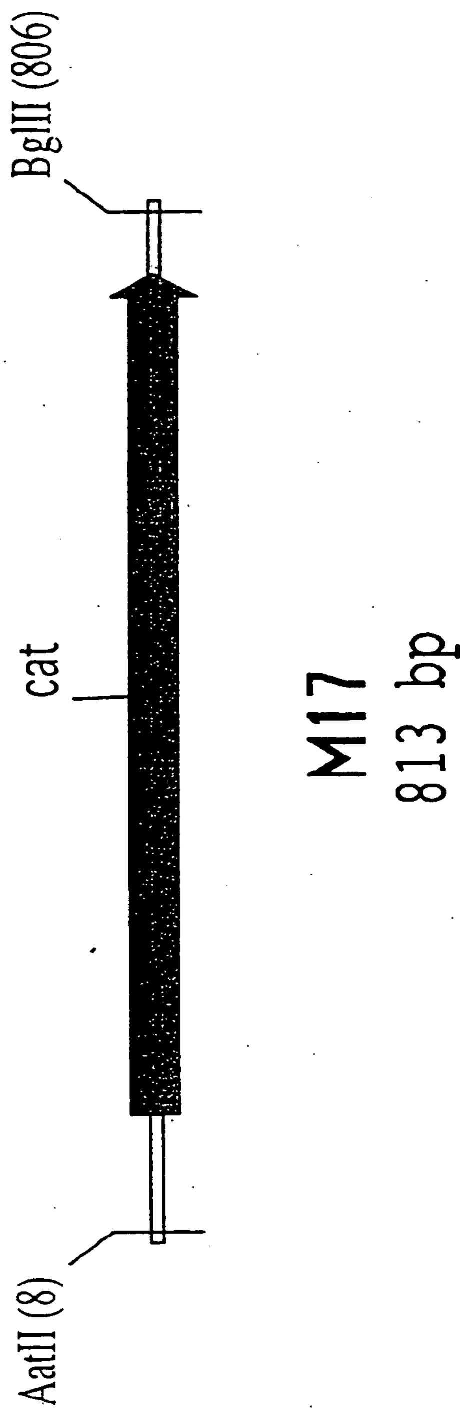



Figure 34: functional map and sequence of pCAL module M17

Figure 34: functional map and sequence of pCAL module M17 (continued)

```
        AatII
         ~~~~~~
  1   GGGACGTCGG GTGAGGTTCC AACTTTCACC ATAATGAAAT AAGATCACTA
      CCCTGCAGCC CACTCCAAGG TTGAAAGTGG TATTACTTTA TTCTAGTGAT

 51   CCGGGCGTAT TTTTTGAGTT ATCGAGATTT TCAGGAGCTA AGGAAGCTAA
      GGCCCGCATA AAAAACTCAA TAGCTCTAAA AGTCCTCGAT TCCTTCGATT

101   AATGGAGAAA AAAATCACTG GATATACCAC CGTTGATATA TCCCAATGGC
      TTACCTCTTT TTTTAGTGAC CTATATGGTG GCAACTATAT AGGGTTACCG

151   ATCGTAAAGA ACATTTTGAG GCATTTCAGT CAGTTGCTCA ATGTACCTAT
      TAGCATTTCT TGTAAAACTC CGTAAAGTCA GTCAACGAGT TACATGGATA

201   AACCAGACCG TTCAGCTGGA TATTACGGCC TTTTTAAAGA CCGTAAAGAA
      TTGGTCTGGC AAGTCGACCT ATAATGCCGG AAAAATTTCT GGCATTTCTT

251   AAATAAGCAC AAGTTTTATC CGGCCTTTAT TCACATTCTT GCCCGCCTGA
      TTTATTCGTG TTCAAAATAG GCCGGAAATA AGTGTAAGAA CGGGCGGACT

301   TGAATGCTCA CCCGGAGTTC CGTATGGCAA TGAAAGACGG TGAGCTGGTG
      ACTTACGAGT GGGCCTCAAG GCATACCGTT ACTTTCTGCC ACTCGACCAC

351   ATATGGATAA GTGTTCACCC TTGTTACACC GTTTTCCATG AGCAAACTGA
```

00h2T0 " h9006h60

Figure 34: functional map and sequence of pCAL module M17 (continued)

```
     TATACCCTAT CACAAGTGGG AACAATGTGG CAAAAGGTAC TCGTTTGACT

401  AACGTTTTCA TCGCTCTGGA GTGAATACCA CGACGATTTC CGGCAGTTTC
     TTGCAAAAGT AGCGAGACCT CACTTATGGT GCTGCTAAAG GCCGTCAAAG

451  TACACATATA TTCGCAAGAT GTGGCGTGTT ACGGTGAAAA CCTGGCCTAT
     ATGTGTATAT AAGCGTTCTA CACCGCACAA TGCCACTTTT GGACCGGATA

501  TTCCCTAAAG GGTTTATTGA GAATATGTTT TTCGTCTCAG CCAATCCCTG
     AAGGGATTTC CCAAATAACT CTTATACAAA AAGCAGAGTC GGTTAGGGAC

551  GGTGAGTTTC ACCAGTTTTG ATTTAAACGT AGCCAATATG GACAACTTCT
     CCACTCAAAG TGGTCAAAAC TAAATTTGCA TCGGTTATAC CTGTTGAAGA

601  TCGCCCCCGT TTTCACTATG GGCAAATATT ATACGCAAGG CGACAAGGTG
     AGCGGGGGCA AAAGTGATAC CCGTTTATAA TATGCGTTCC GCTGTTCCAC

651  CTGATGCCGC TGGCGATTCA GGTTCATCAT GCCGTTTGTG ATGGCTTCCA
     GACTACGGCG ACCGCTAAGT CCAAGTAGTA CGGCAAACAC TACCGAAGGT

701  TGTCGGCAGA ATGCTTAATG AATTACAACA GTACTGCGAT GAGTGGCAGG
     ACAGCCGTCT TACGAATTAC TTAATGTTGT CATGACGCTA CTCACCGTCC

751  GCGGGGCGTA ATTTTTTTAA GGCAGTTATT GGGTGCCCTT AAACGCCTGG
```

Figure 34: functional map and sequence of pCAL module M17 (continued)

```
      CGCCCCGCAT TAAAAAAATT CCGTCAATAA CCCACGGGAA TTTGCGGACC

             BglII
            ~~~~~~
801   TGCTAGATCT TCC
      ACGATCTAGA AGG
```

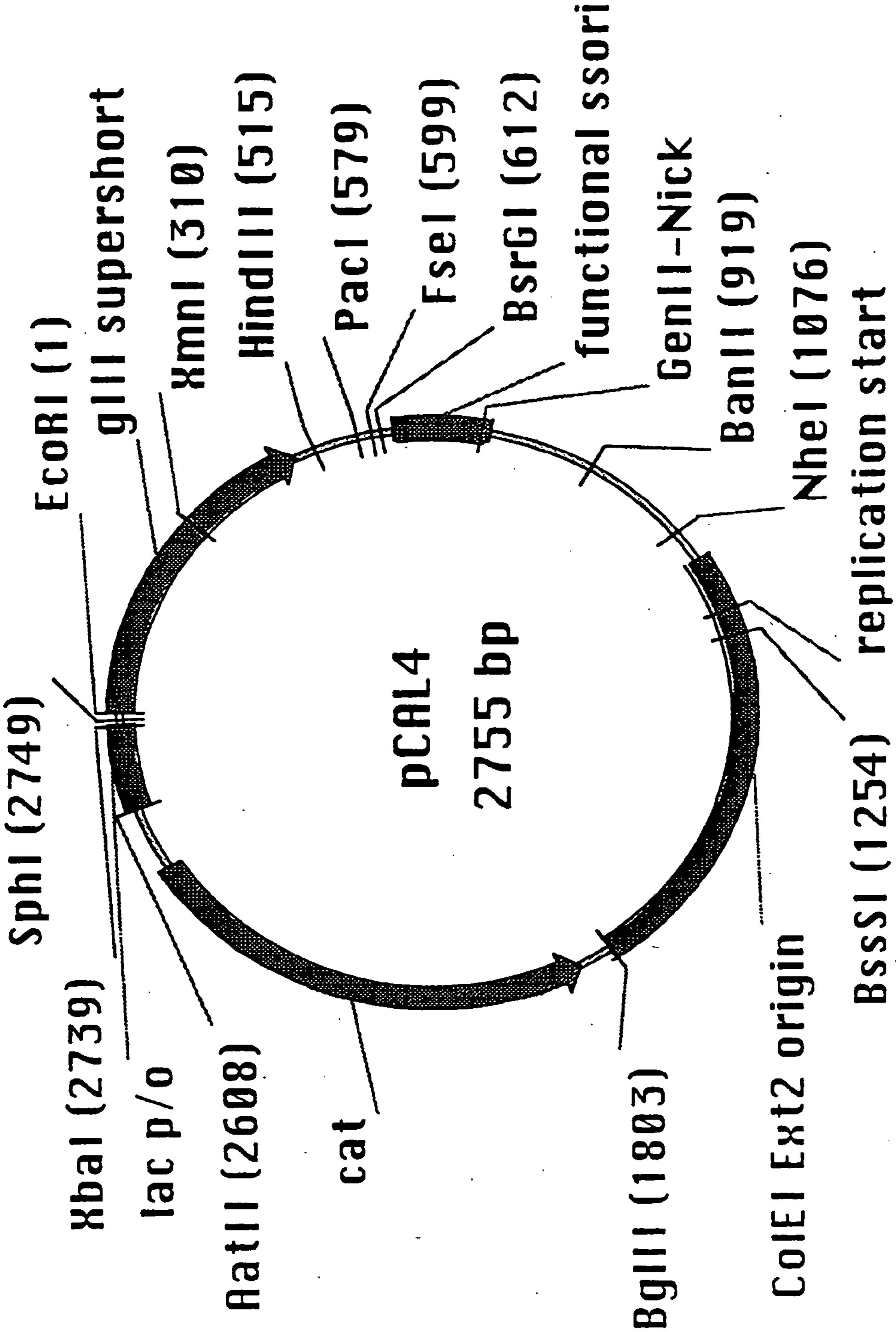



Figure 35: functional map and sequence of modular vector pCAL4

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```
        EcoRI
        ~~~~~
  1     AATTCGAGCA GAAGCTGATC TCTGAGGAGG ATCTGTAGGG TGGTGGCTCT
        TTAAGCTCGT CTTCGACTAG AGACTCCTCC TAGACATCCC ACCACCGAGA

 51     GGTTCCGGTG ATTTTGATTA TGAAAAGATG GCAAACGCTA ATAAGGGGGC
        CCAAGGCCAC TAAAACTAAT ACTTTTCTAC CGTTTGCGAT TATTCCCCCG

101     TATGACCGAA AATGCCGATG AAAACGCGCT ACAGTCTGAC GCTAAAGGCA
        ATACTGGCTT TTACGGCTAC TTTTGCGCGA TGTCAGACTG CGATTTCCGT

151     AACTTGATTC TGTCGCTACT GATTACGGTG CTGCTATCGA TGGTTTCATT
        TTGAACTAAG ACAGCGATGA CTAATGCCAC GACGATAGCT ACCAAAGTAA

201     GGTGACGTTT CCGGCCTTGC TAATGGTAAT GGTGCTACTG GTGATTTTGC
        CCACTGCAAA GGCCGGAACG ATTACCATTA CCACGATGAC CACTAAAACG

251     TGGCTCTAAT TCCCAAATGG CTCAAGTCGG TGACGGTGAT AATTCACCTT
        ACCGAGATTA AGGGTTTACC GAGTTCAGCC ACTGCCACTA TTAAGTGGAA

                    XmnI
              ~~~~~~~~~~~~
301     TAATGAATAA TTTCCGTCAA TATTTACCTT CCCTCCCTCA ATCGGTTGAA
        ATTACTTATT AAAGGCAGTT ATAAATGGAA GGGAGGGAGT TAGCCAACTT
```

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```
351  TGTCGCCCTT TTGTCTTTGG CGCTGGTAAA CCATATGAAT TTTCTATTGA
     ACAGCGGGAA AACAGAAACC GCGACCATTT GGTATACTTA AAAGATAACT

401  TTGTGACAAA ATAAACTTAT TCCGTGGTGT CTTTGCGTTT CTTTTATATG
     AACACTGTTT TATTTGAATA AGGCACCACA GAAACGCAAA GAAAATATAC

451  TTGCCACCTT TATGTATGTA TTTTCTACGT TTGCTAACAT ACTGCGTAAT
     AACGGTGGAA ATACATACAT AAAAGATGCA AACGATTGTA TGACGCATTA

                  HindIII
                  ~~~~~~
501  AAGGAGTCTT GATAAGCTTG ACCTGTGAAG TGAAAAATGG CGCAGATTGT
     TTCCTCAGAA CTATTCGAAC TGGACACTTC ACTTTTTACC GCGTCTAACA

                              PacI             FseI
                           ~~~~~~~~        ~~~~~~~~
551  GCGACATTTT TTTTGTCTGC CGTTTAATTA AAGGGGGGGG GGGGCCGGCC
     CGCTGTAAAA AAAACAGACG GCAAATTAAT TTCCCCCCCC CCCCGGCCGG

                 BsrGI
                ~~~~~~
601  TGGGGGGGGG TGTACATGAA ATTGTAAACG TTAATATTTT GTTAAAATTC
     ACCCCCCCCC ACATGTACTT TAACATTTGC AATTATAAAA CAATTTTAAG
```

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```
651  GCGTTAAATT TTTGTTAAAT CAGCTCATTT TTTAACCAAT AGGCCGAAAT
     CGCAATTTAA AAACAATTTA GTCGAGTAAA AAATTGGTTA TCCGGCTTTA

701  CGGCAAAATC CCTTATAAAT CAAAAGAATA GACCGAGATA GGGTTGAGTG
     GCCGTTTTAG GGAATATTTA GTTTTCTTAT CTGGCTCTAT CCCAACTCAC

751  TTGTTCCAGT TTGGAACAAG AGTCCACTAT TAAAGAACGT GGACTCCAAC
     AACAAGGTCA AACCTTGTTC TCAGGTGATA ATTTCTTGCA CCTGAGGTTG

801  GTCAAAGGGC GAAAAACCGT CTATCAGGGC GATGGCCCAC TACGAGAACC
     CAGTTTCCCG CTTTTTGGCA GATAGTCCCG CTACCGGGTG ATGCTCTTGG

851  ATCACCCTAA TCAAGTTTTT TGGGGTCGAG GTGCCGTAAA GCACTAAATC
     TAGTGGGATT AGTTCAAAAA ACCCCAGCTC CACGGCATTT CGTGATTTAG

                         BanII
                        ~~~~~~~
901  GGAACCCTAA AGGGAGCCCC CGATTTAGAG CTTGACGGGG AAAGCCGGCG
     CCTTGGGATT TCCCTCGGGG GCTAAATCTC GAACTGCCCC TTTCGGCCGC

951  AACGTGGCGA GAAAGGAAGG GAAGAAAGCG AAAGGAGCGG GCGCTAGGGC
     TTGCACCGCT CTTTCCTTCC CTTCTTTCGC TTTCCTCGCC CGCGATCCCG
```

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Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```
1001  GCTGGCAAGT GTAGCGGTCA CGCTGCGCGT AACCACCACA CCCGCCGCGC
      CGACCGTTCA CATCGCCAGT GCGACGCGCA TTGGTGGTGT GGGCGGCGCG

                                NheI
                               ~~~~~~~
1051  TTAATGCGCC GCTACAGGGC GCGTGCTAGC CATGTGAGCA AAAGGCCAGC
      AATTACGCGG CGATGTCCCG CGCACGATCG GTACACTCGT TTTCCGGTCG

1101  AAAAGGCCAG GAACCGTAAA AAGGCCGCGT TGCTGGCGTT TTTCCATAGG
      TTTTCCGGTC CTTGGCATTT TTCCGGCGCA ACGACCGCAA AAAGGTATCC

1151  CTCCGCCCCC CTGACGAGCA TCACAAAAAT CGACGCTCAA GTCAGAGGTG
      GAGGCGGGGG GACTGCTCGT AGTGTTTTTA GCTGCGAGTT CAGTCTCCAC

1201  GCGAAACCCG ACAGGACTAT AAAGATACCA GGCGTTTCCC CCTGGAAGCT
      CGCTTTGGGC TGTCCTGATA TTTCTATGGT CCGCAAAGGG GGACCTTCGA

        BssSI
       ~~~~~~~
1251  CCCTCGTGCG CTCTCCTGTT CCGACCCTGC CGCTTACCGG ATACCTGTCC
      GGGAGCACGC GAGAGGACAA GGCTGGGACG GCGAATGGCC TATGGACAGG

1301  GCCTTTCTCC CTTCGGGAAG CGTGGCGCTT TCTCATAGCT CACGCTGTAG
      CGGAAAGAGG GAAGCCCTTC GCACCGCGAA AGAGTATCGA GTGCGACATC
```

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Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```
1351  GTATCTCAGT TCGGTGTAGG TCGTTCGCTC CAAGCTGGGC TGTGTGCACG
      CATAGAGTCA AGCCACATCC AGCAAGCGAG GTTCGACCCG ACACACGTGC

1401  AACCCCCCGT TCAGCCCGAC CGCTGCGCCT TATCCGGTAA CTATCGTCTT
      TTGGGGGGCA AGTCGGGCTG GCGACGCGGA ATAGGCCATT GATAGCAGAA

1451  GAGTCCAACC CGGTAAGACA CGACTTATCG CCACTGGCAG CAGCCACTGG
      CTCAGGTTGG GCCATTCTGT GCTGAATAGC GGTGACCGTC GTCGGTGACC

1501  TAACAGGATT AGCAGAGCGA GGTATGTAGG CGGTGCTACA GAGTTCTTGA
      ATTGTCCTAA TCGTCTCGCT CCATACATCC GCCACGATGT CTCAAGAACT

1551  AGTGGTGGCC TAACTACGGC TACACTAGAA GAACAGTATT TGGTATCTGC
      TCACCACCGG ATTGATGCCG ATGTGATCTT CTTGTCATAA ACCATAGACG

1601  GCTCTGCTGT AGCCAGTTAC CTTCGGAAAA AGAGTTGGTA GCTCTTGATC
      CGAGACGACA TCGGTCAATG GAAGCCTTTT TCTCAACCAT CGAGAACTAG

1651  CGGCAAACAA ACCACCGCTG GTAGCGGTGG TTTTTTTGTT TGCAAGCAGC
      GCCGTTTGTT TGGTGGCGAC CATCGCCACC AAAAAAACAA ACGTTCGTCG

1701  AGATTACGCG CAGAAAAAAA GGATCTCAAG AAGATCCTTT GATCTTTTCT
      TCTAATGCGC GTCTTTTTTT CCTAGAGTTC TTCTAGGAAA CTAGAAAAGA
```

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```
1751   ACGGGGTCTG ACGCTCAGTG GAACGAAAAC TCACGTTAAG GGATTTTGGT
       TGCCCCAGAC TGCGAGTCAC CTTGCTTTTG AGTGCAATTC CCTAAAACCA

        BglII
       ~~~~~~
1801   CAGATCTAGC ACCAGGCGTT TAAGGGCACC AATAACTGCC TTAAAAAAAT
       GTCTAGATCG TGGTCCGCAA ATTCCCGTGG TTATTGACGG AATTTTTTTA

1851   TACGCCCCGC CCTGCCACTC ATCGCAGTAC TGTTGTAATT CATTAAGCAT
       ATGCGGGGCG GGACGGTGAG TAGCGTCATG ACAACATTAA GTAATTCGTA

1901   TCTGCCGACA TGGAAGCCAT CACAAACGGC ATGATGAACC TGAATCGCCA
       AGACGGCTGT ACCTTCGGTA GTGTTTGCCG TACTACTTGG ACTTAGCGGT

1951   GCGGCATCAG CACCTTGTCG CCTTGCGTAT AATATTTGCC CATAGTGAAA
       CGCCGTAGTC GTGGAACAGC GGAACGCATA TTATAAACGG GTATCACTTT

2001   ACGGGGGCGA AGAAGTTGTC CATATTGGCT ACGTTTAAAT CAAAACTGGT
       TGCCCCCGCT TCTTCAACAG GTATAACCGA TGCAAATTTA GTTTTGACCA

2051   GAAACTCACC CAGGGATTGG CTGAGACGAA AAACATATTC TCAATAAACC
       CTTTGAGTGG GTCCCTAACC GACTCTGCTT TTTGTATAAG AGTTATTTGG
```

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```
2101  CTTTAGGGAA ATAGGCCAGG TTTTCACCGT AACACGCCAC ATCTTGCGAA
      GAAATCCCTT TATCCGGTCC AAAAGTGGCA TTGTGCGGTG TAGAACGCTT

2151  TATATGTGTA GAAACTGCCG GAAATCGTCG TGGTATTCAC TCCAGAGCGA
      ATATACACAT CTTTGACGGC CTTTAGCAGC ACCATAAGTG AGGTCTCGCT

2201  TGAAAACGTT TCAGTTTGCT CATGGAAAAC GGTGTAACAA GGGTGAACAC
      ACTTTTGCAA AGTCAAACGA GTACCTTTTG CCACATTGTT CCCACTTGTG

2251  TATCCCATAT CACCAGCTCA CCGTCTTTCA TTGCCATACG GAACTCCGGG
      ATAGGGTATA GTGGTCGAGT GGCAGAAAGT AACGGTATGC CTTGAGGCCC

2301  TGAGCATTCA TCAGGCGGGC AAGAATGTGA ATAAAGGCCG GATAAAACTT
      ACTCGTAAGT AGTCCGCCCG TTCTTACACT TATTTCCGGC CTATTTTGAA

2351  GTGCTTATTT TTCTTTACGG TCTTTAAAAA GGCCGTAATA TCCAGCTGAA
      CACGAATAAA AAGAAATGCC AGAAATTTTT CCGGCATTAT AGGTCGACTT

2401  CGGTCTGGTT ATAGGTACAT TGAGCAACTG ACTGAAATGC CTCAAAATGT
      GCCAGACCAA TATCCATGTA ACTCGTTGAC TGACTTTACG GAGTTTTACA

2451  TCTTTACGAT GCCATTGGGA TATATCAACG GTGGTATATC CAGTGATTTT
      AGAAATGCTA CGGTAACCCT ATATAGTTGC CACCATATAG GTCACTAAAA
```

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```
2501   TTTCTCCATT TTAGCTTCCT TAGCTCCTGA AAATCTCGAT AACTCAAAAA
       AAAGAGGTAA AATCGAAGGA ATCGAGGACT TTTAGAGCTA TTGAGTTTTT

2551   ATACGCCCGG TAGTGATCTT ATTTCATTAT GGTGAAAGTT GGAACCTCAC
       TATGCGGGCC ATCACTAGAA TAAAGTAATA CCACTTTCAA CCTTGGAGTG

         AatII
        ~~~~~~
2601   CCGACGTCTA ATGTGAGTTA GCTCACTCAT TAGGCACCCC AGGCTTTACA
       GGCTGCAGAT TACACTCAAT CGAGTGAGTA ATCCGTGGGG TCCGAAATGT

2651   CTTTATGCTT CCGGCTCGTA TGTTGTGTGG AATTGTGAGC GGATAACAAT
       GAAATACGAA GGCCGAGCAT ACAACACACC TTAACACTCG CCTATTGTTA

                                          XbaI    SphI
                                        ~~~~~~~~~~~~~~
2701   TTCACACAGG AAACAGCTAT GACCATGATT ACGAATTTCT AGAGCATGCG
       AAGTGTGTCC TTTGTCGATA CTGGTACTAA TGCTTAAAGA TCTCGTACGC

       EcoRI

2751   GGGGG
       CCCCC
```

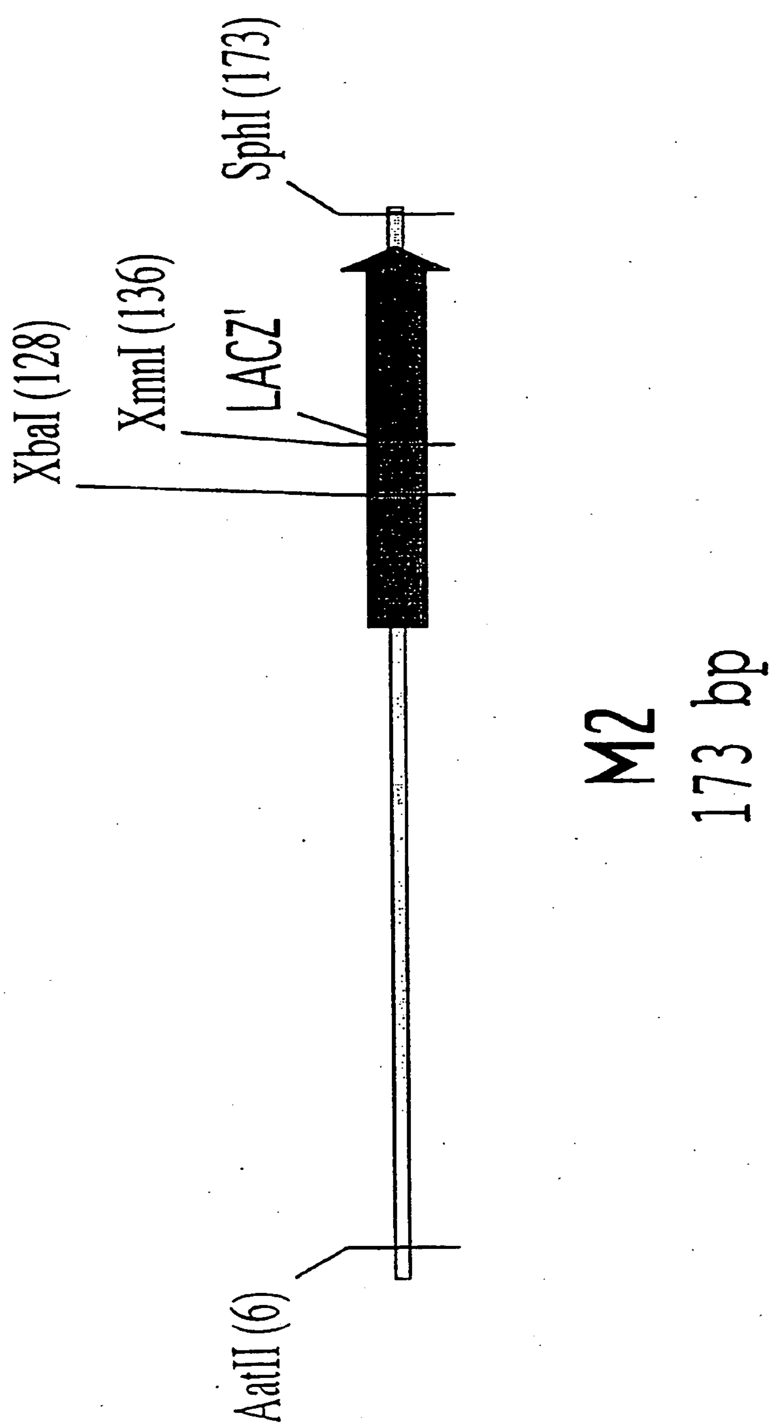


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors

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Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

**M 2:**

```
      AatII
      ~~~~~~~
  1   GACGTCTTAA TGTGAGTTAG CTCACTCATT AGGCACCCCA GGCTTTACAC
      CTGCAGAATT ACACTCAATC GAGTGAGTAA TCCGTGGGGT CCGAAATGTG

 51   TTTATGCTTC CGGCTCGTAT GTTGTGTGGA ATTGTGAGCG GATAACAATT
      AAATACGAAG GCCGAGCATA CAACACACCT TAACACTCGC CTATTGTTAA

                                           XmnI
                                      ~~~~~~~~~~~
                                 XbaI
                               ~~~~~~~~
101   TCACACAGGA AACAGCTATG ACCATGTCTA GAATAACTTC GTATAATGTA
      AGTGTGTCCT TTGTCGATAC TGGTACAGAT CTTATTGAAG CATATTACAT

                      SphI
                    ~~~~~~
151   CGCTATACGA AGTTATCGCA TGC
      GCGATATGCT TCAATAGCGT ACG
```

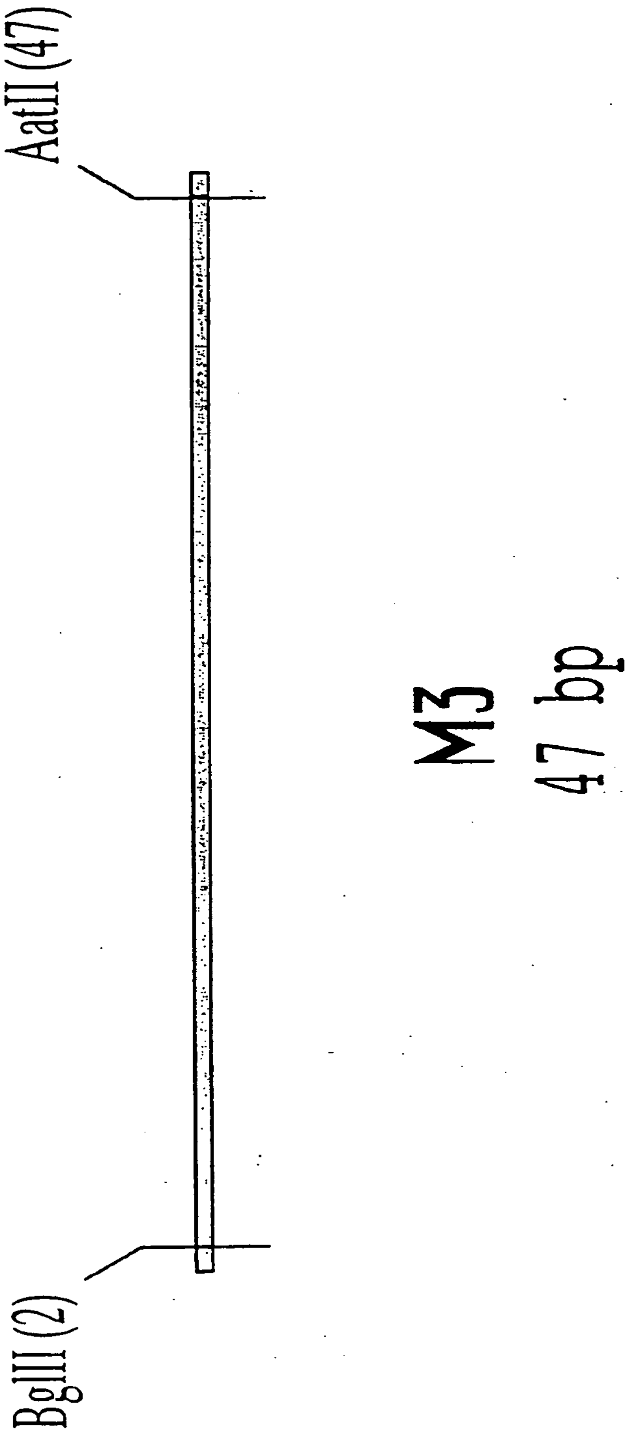


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

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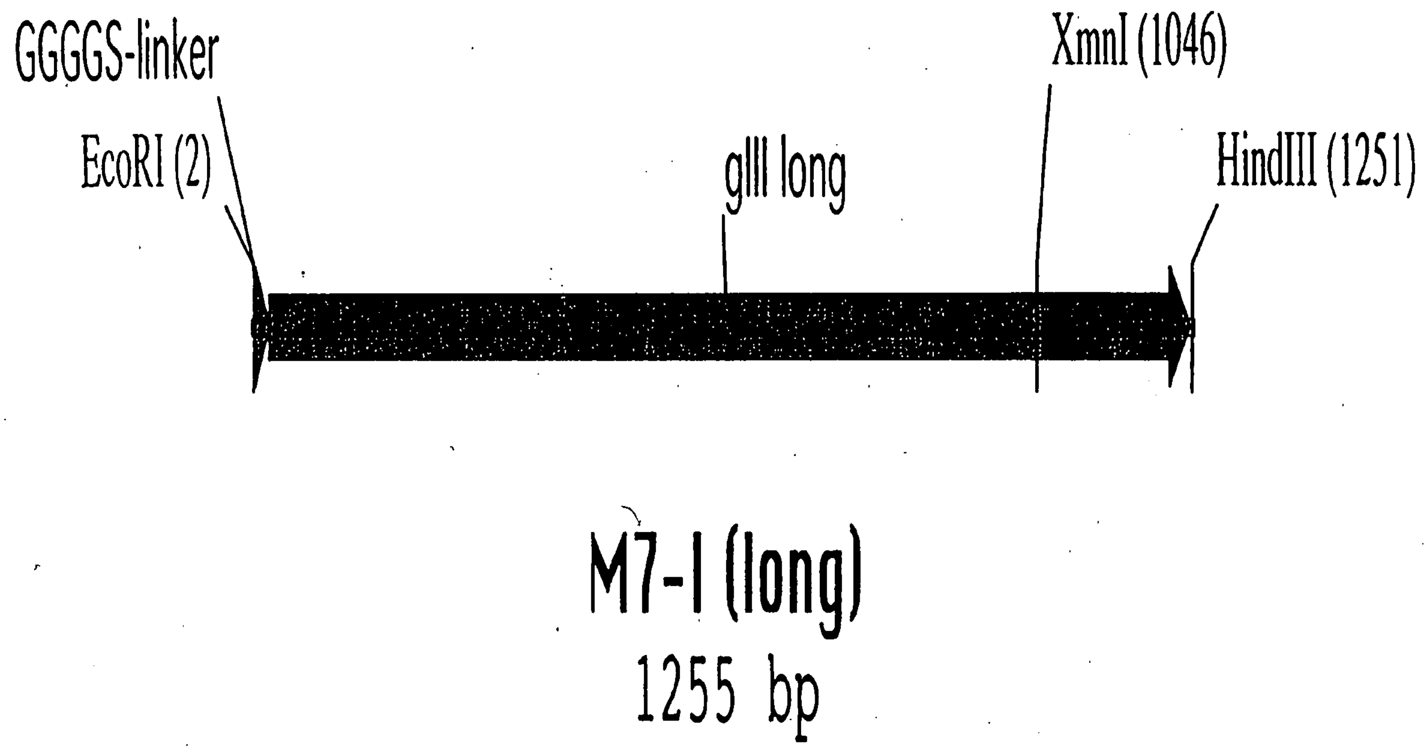
Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
M 3:

    BglII                                                  AatII
   ~~~~~~                                                  ~~~~~~
1  AGATCTCATA ACTTCGTATA ATGTATGCTA TACGAAGTTA TGACGTC
   TCTAGAGTAT TGAAGCATAT TACATACGAT ATGCTTCAAT ACTGCAG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)



00420 " 19006460

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

**M 7-I (long):**

```
      EcoRI
      ~~~~~~
  1   GAATTCGGTG GTGGTGGATC TGCGTGCGCT GAAACGGTTG AAAGTTGTTT
      CTTAAGCCAC CACCACCTAG ACGCACGCGA CTTTGCCAAC TTTCAACAAA

 51   AGCAAAATCC CATACAGAAA ATTCATTTAC TAACGTCTGG AAAGACGACA
      TCGTTTTAGG GTATGTCTTT TAAGTAAATG ATTGCAGACC TTTCTGCTGT

101   AAACTTTAGA TCGTTACGCT AACTATGAGG GCTGTCTGTG GAATGCTACA
      TTTGAAATCT AGCAATGCGA TTGATACTCC CGACAGACAC CTTACGATGT

151   GGCGTTGTAG TTTGTACTGG TGACGAAACT CAGTGTTACG GTACATGGGT
      CCGCAACATC AAACATGACC ACTGCTTTGA GTCACAATGC CATGTACCCA

201   TCCTATTGGG CTTGCTATCC CTGAAAATGA GGGTGGTGGC TCTGAGGGTG
      AGGATAACCC GAACGATAGG GACTTTTACT CCCACCACCG AGACTCCCAC

251   GCGGTTCTGA GGGTGGCGGT TCTGAGGGTG GCGGTACTAA ACCTCCTGAG
      CGCCAAGACT CCCACCGCCA AGACTCCCAC CGCCATGATT TGGAGGACTC

301   TACGGTGATA CACCTATTCC GGGCTATACT TATATCAACC CTCTCGACGG
      ATGCCACTAT GTGGATAAGG CCCGATATGA ATATAGTTGG GAGAGCTGCC
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
351  CACTTATCCG CCTGGTACTG AGCAAAACCC CGCTAATCCT AATCCTTCTC
     GTGAATAGGC GGACCATGAC TCGTTTTGGG GCGATTAGGA TTAGGAAGAG

401  TTGAGGAGTC TCAGCCTCTT AATACTTTCA TGTTTCAGAA TAATAGGTTC
     AACTCCTCAG AGTCGGAGAA TTATGAAAGT ACAAAGTCTT ATTATCCAAG

451  CGAAATAGGC AGGGGGCATT AACTGTTTAT ACGGGCACTG TTACTCAAGG
     GCTTTATCCG TCCCCCGTAA TTGACAAATA TGCCCGTGAC AATGAGTTCC

501  CACTGACCCC GTTAAAACTT ATTACCAGTA CACTCCTGTA TCATCAAAAG
     GTGACTGGGG CAATTTTGAA TAATGGTCAT GTGAGGACAT AGTAGTTTTC

551  CCATGTATGA CGCTTACTGG AACGGTAAAT TCAGAGACTG CGCTTTCCAT
     GGTACATACT GCGAATGACC TTGCCATTTA AGTCTCTGAC GCGAAAGGTA

601  TCTGGCTTTA ATGAGGATTT ATTTGTTTGT GAATATCAAG GCCAATCGTC
     AGACCGAAAT TACTCCTAAA TAAACAAACA CTTATAGTTC CGGTTAGCAG

651  TGACCTGCCT CAACCTCCTG TCAATGCTGG CGGCGGCTCT GGTGGTGGTT
     ACTGGACGGA GTTGGAGGAC AGTTACGACC GCCGCCGAGA CCACCACCAA

701  CTGGTGGCGG CTCTGAGGGT GGTGGCTCTG AGGGTGGCGG TTCTGAGGGT
     GACCACCGCC GAGACTCCCA CCACCGAGAC TCCCACCGCC AAGACTCCCA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
751   GGCGGCTCTG AGGGAGGCGG TTCCGGTGGT GGCTCTGGTT CCGGTGATTT
      CCGCCGAGAC TCCCTCCGCC AAGGCCACCA CCGAGACCAA GGCCACTAAA

801   TGATTATGAA AAGATGGCAA ACGCTAATAA GGGGGCTATG ACCGAAAATG
      ACTAATACTT TTCTACCGTT TGCGATTATT CCCCCGATAC TGGCTTTTAC

851   CCGATGAAAA CGCGCTACAG TCTGACGCTA AAGGCAAACT TGATTCTGTC
      GGCTACTTTT GCGCGATGTC AGACTGCGAT TTCCGTTTGA ACTAAGACAG

901   GCTACTGATT ACGGTGCTGC TATCGATGGT TTCATTGGTG ACGTTTCCGG
      CGATGACTAA TGCCACGACG ATAGCTACCA AAGTAACCAC TGCAAAGGCC

951   CCTTGCTAAT GGTAATGGTG CTACTGGTGA TTTTGCTGGC TCTAATTCCC
      GGAACGATTA CCATTACCAC GATGACCACT AAAACGACCG AGATTAAGGG

                                                  XmnI
                                               ~~~~~~~~~~
1001  AAATGGCTCA AGTCGGTGAA GGTGATAATT CACCTTTAAT GAATAATTTC
      TTTACCGAGT TCAGCCACTT CCACTATTAA GTGGAAATTA CTTATTAAAG

1051  CGTCAATATT TACCTTCCAT CCCTCAATCG GTTGAATGTC GCCCTTTTGT
      GCAGTTATAA ATGGAAGGTA GGGAGTTAGC CAACTTACAG CGGGAAAACA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
1101  CTTTGGCGCT GGTAAACCCT ATGAATTTTC TATTGATTGT GACAAAATAA
      GAAACCGCGA CCATTTGGGA TACTTAAAAG ATAACTAACA CTGTTTTATT

1151  ACTTATTCCG TGGTGTCTTT GCGTTTCTTT TATATGTTGC CACCTTTATG
      TGAATAAGGC ACCACAGAAA CGCAAAGAAA ATATACAACG GTGGAAATAC

                                                    HindIII
                                                          ~
1201  TATGTATTTT CTACGTTTGC TAACATACTG CGTAATAAGG AGTCTTGATA
      ATACATAAAA GATGCAAACG ATTGTATGAC GCATTATTCC TCAGAACTAT

      HindI
      ~~~~~
1251  AGCTT
      TCGAA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

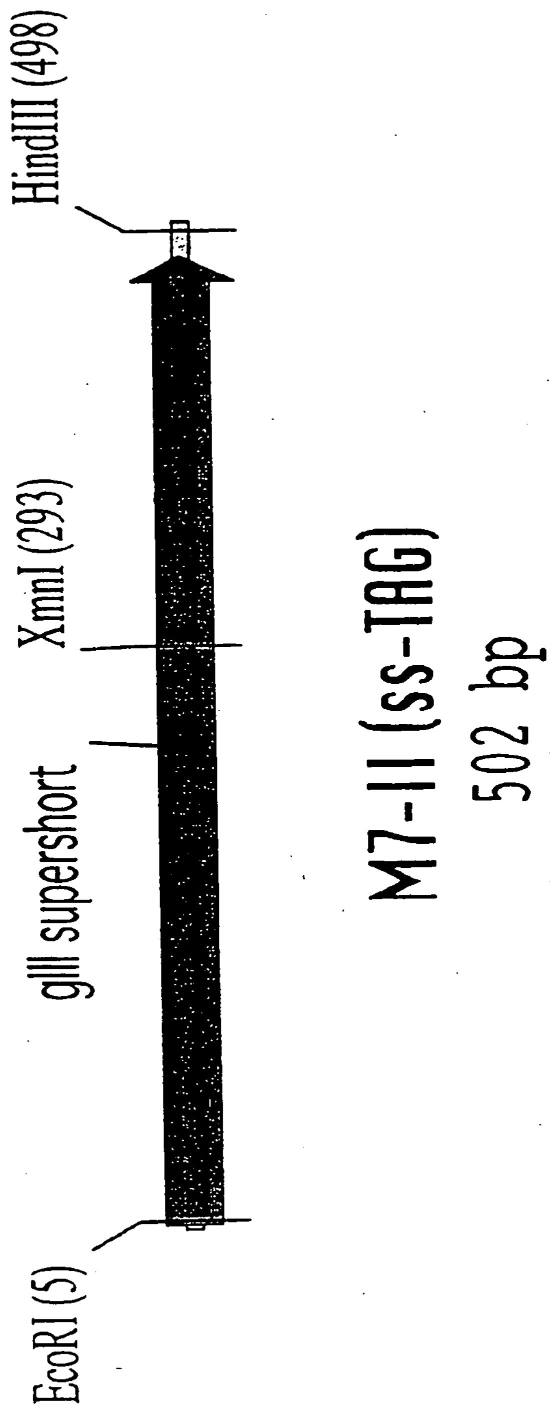


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

**M 7-II (ss-TAG):**

```
         EcoRI
        ~~~~~~~
  1   CGGGAATTCG GAGGCGGTTC CGGTGGTGGC TCTGGTTCCG GTGATTTTGA
      GCCCTTAAGC CTCCGCCAAG GCCACCACCG AGACCAAGGC CACTAAAACT

 51   TTATGAAAAG ATGGCAAACG CTAATAAGGG GGCTATGACC GAAAATGCCG
      AATACTTTTC TACCGTTTGC GATTATTCCC CCGATACTGG CTTTTACGGC

101   ATGAAAACGC GCTACAGTCT GACGCTAAAG GCAAACTTGA TTCTGTCGCT
      TACTTTTGCG CGATGTCAGA CTGCGATTTC CGTTTGAACT AAGACAGCGA

151   ACTGATTACG GTGCTGCTAT CGATGGTTTC ATTGGTGACG TTTCCGGCCT
      TGACTAATGC CACGACGATA GCTACCAAAG TAACCACTGC AAAGGCCGGA

201   TGCTAATGGT AATGGTGCTA CTGGTGATTT TGCTGGCTCT AATTCCCAAA
      ACGATTACCA TTACCACGAT GACCACTAAA ACGACCGAGA TTAAGGGTTT

                                                  XmnI
                                             ~~~~~~~~~~~~
251   TGGCTCAAGT CGGTGACGGT GATAATTCAC CTTTAATGAA TAATTTCCGT
      ACCGAGTTCA GCCACTGCCA CTATTAAGTG GAAATTACTT ATTAAAGGCA
```

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Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
301  CAATATTTAC CTTCCCTCCC TCAATCGGTT GAATGTCGCC CTTTTGTCTT
     GTTATAAATG GAAGGGAGGG AGTTAGCCAA CTTACAGCGG GAAAACAGAA

351  TGGCGCTGGT AAACCATATG AATTTTCTAT TGATTGTGAC AAAATAAACT
     ACCGCGACCA TTTGGTATAC TTAAAAGATA ACTAACACTG TTTTATTTGA

401  TATTCCGTGG TGTCTTTGCG TTTCTTTTAT ATGTTGCCAC CTTTATGTAT
     ATAAGGCACC ACAGAAACGC AAAGAAAATA TACAACGGTG GAAATACATA

                                                  HindIII
                                                     ~~~~
451  GTATTTTCTA CGTTTGCTAA CATACTGCGT AATAAGGAGT CTTGATAAGC
     CATAAAAGAT GCAAACGATT GTATGACGCA TTATTCCTCA GAACTATTCG

     Hi
     ~
501  TT
     AA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

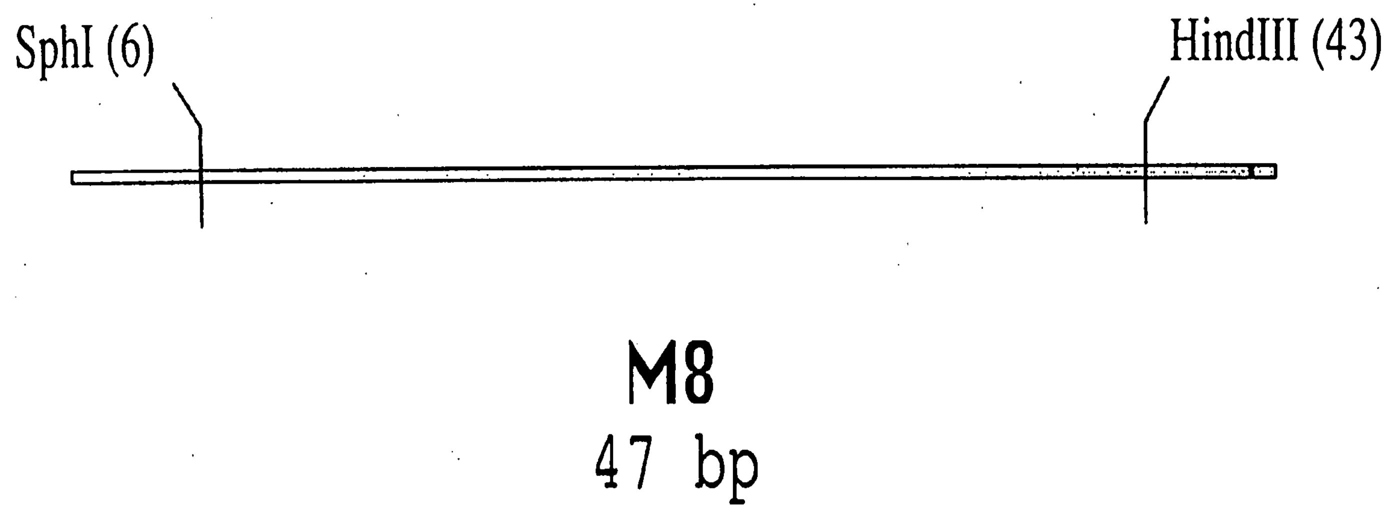

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 8:

```
      SphI                                              HindIII
     ~~~~~~                                              ~~~~~~
1   GCATGCCATA ACTTCGTATA ATGTACGCTA TACGAAGTTA TAAGCTT
    CGTACGGTAT TGAAGCATAT TACATGCGAT ATGCTTCAAT ATTCGAA
```

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Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

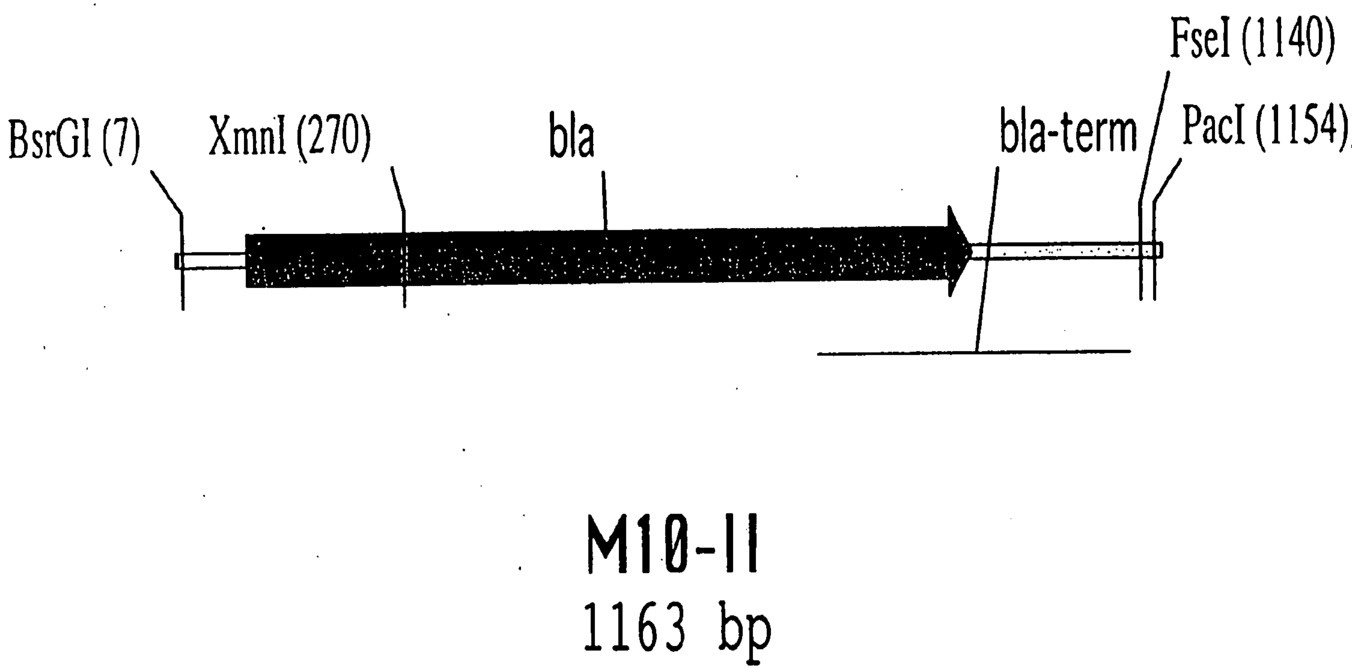

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

## M 10-II:

```
              BsrGI
             ~~~~~~~~
  1  GGGGGTGTAC ATTCAAATAT GTATCCGCTC ATGAGACAAT AACCCTGATA
     CCCCCACATG TAAGTTTATA CATAGGCGAG TACTCTGTTA TTGGGACTAT

 51  AATGCTTCAA TAATATTGAA AAAGGAAGAG TATGAGTATT CAACATTTCC
     TTACGAAGTT ATTATAACTT TTTCCTTCTC ATACTCATAA GTTGTAAAGG

101  GTGTCGCCCT TATTCCCTTT TTTGCGGCAT TTTGCCTTCC TGTTTTTGCT
     CACAGCGGGA ATAAGGGAAA AAACGCCGTA AAACGGAAGG ACAAAAACGA

151  CACCCAGAAA CGCTGGTGAA AGTAAAAGAT GCTGAGGATC AGTTGGGTGC
     GTGGGTCTTT GCGACCACTT TCATTTTCTA CGACTCCTAG TCAACCCACG

201  GCGAGTGGGT TACATCGAAC TGGATCTCAA CAGCGGTAAG ATCCTTGAGA
     CGCTCACCCA ATGTAGCTTG ACCTAGAGTT GTCGCCATTC TAGGAACTCT

                          XmnI
                      ~~~~~~~~~~~~
251  GTTTTCGCCC CGAAGAACGT TTTCCAATGA TGAGCACTTT TAAAGTTCTG
     CAAAAGCGGG GCTTCTTGCA AAAGGTTACT ACTCGTGAAA ATTTCAAGAC
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
301  CTATGTGGCG CGGTATTATC CCGTATTGAC GCCGGGCAAG AGCAACTCGG
     GATACACCGC GCCATAATAG GGCATAACTG CGGCCCGTTC TCGTTGAGCC

351  TCGCCGCATA CACTATTCTC AGAATGACTT GGTTGAGTAC TCACCAGTCA
     AGCGGCGTAT GTGATAAGAG TCTTACTGAA CCAACTCATG AGTGGTCAGT

401  CAGAAAAGCA TCTTACGGAT GGCATGACAG TAAGAGAATT ATGCAGTGCT
     GTCTTTTCGT AGAATGCCTA CCGTACTGTC ATTCTCTTAA TACGTCACGA

451  GCCATAACCA TGAGTGATAA CACTGCGGCC AACTTACTTC TGACAACGAT
     CGGTATTGGT ACTCACTATT GTGACGCCGG TTGAATGAAG ACTGTTGCTA

501  CGGAGGACCG AAGGAGCTAA CCGCTTTTTT GCACAACATG GGGGATCATG
     GCCTCCTGGC TTCCTCGATT GGCGAAAAAA CGTGTTGTAC CCCCTAGTAC

551  TAACTCGCCT TGATCGTTGG GAACCGGAGC TGAATGAAGC CATACCAAAC
     ATTGAGCGGA ACTAGCAACC CTTGGCCTCG ACTTACTTCG GTATGGTTTG

601  GACGAGCGTG ACACCACGAT GCCTGTAGCA ATGGCAACAA CGTTGCGCAA
     CTGCTCGCAC TGTGGTGCTA CGGACATCGT TACCGTTGTT GCAACGCGTT

651  ACTATTAACT GGCGAACTAC TTACTCTAGC TTCCCGGCAA CAGTTAATAG
     TGATAATTGA CCGCTTGATG AATGAGATCG AAGGGCCGTT GTCAATTATC
```

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Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
 701  ACTGGATGGA GGCGGATAAA GTTGCAGGAC CACTTCTGCG CTCGGCCCTT
      TGACCTACCT CCGCCTATTT CAACGTCCTG GTGAAGACGC GAGCCGGGAA

 751  CCGGCTGGCT GGTTTATTGC TGATAAATCT GGAGCCGGTG AGCGTGGGTC
      GGCCGACCGA CCAAATAACG ACTATTTAGA CCTCGGCCAC TCGCACCCAG

 801  TCGCGGTATC ATTGCAGCAC TGGGGCCAGA TGGTAAGCCC TCCCGTATCG
      AGCGCCATAG TAACGTCGTG ACCCCGGTCT ACCATTCGGG AGGGCATAGC

 851  TAGTTATCTA CACGACGGGG AGTCAGGCAA CTATGGATGA ACGAAATAGA
      ATCAATAGAT GTGCTGCCCC TCAGTCCGTT GATACCTACT TGCTTTATCT

 901  CAGATCGCTG AGATAGGTGC CTCACTGATT AAGCATTGGG TAACTGTCAG
      GTCTAGCGAC TCTATCCACG GAGTGACTAA TTCGTAACCC ATTGACAGTC

 951  ACCAAGTTTA CTCATATATA CTTTAGATTG ATTTAAAACT TCATTTTTAA
      TGGTTCAAAT GAGTATATAT GAAATCTAAC TAAATTTTGA AGTAAAAATT

1001  TTTAAAAGGA TCTAGGTGAA GATCCTTTTT GATAATCTCA TGACCAAAAT
      AAATTTTCCT AGATCCACTT CTAGGAAAAA CTATTAGAGT ACTGGTTTTA

1051  CCCTTAACGT GAGTTTTCGT TCCACTGAGC GTCAGACCCC GTAGAAAAGA
      GGGAATTGCA CTCAAAAGCA AGGTGACTCG CAGTCTGGGG CATCTTTTCT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
                                                FseI         PacI
                                             ~~~~~~~~~~        ~~
1101  TCAAAGGATC TTCTTGAGAT CCTTTTTGAT AATGGCCGGC CCCCCCCCTT
      AGTTTCCTAG AAGAACTCTA GGAAAAACTA TTACCGGCCG GGGGGGGGAA

      PacI
      ~~~~~~
1151  AATTAAGGGG GGG
      TTAATTCCCC CCC
```

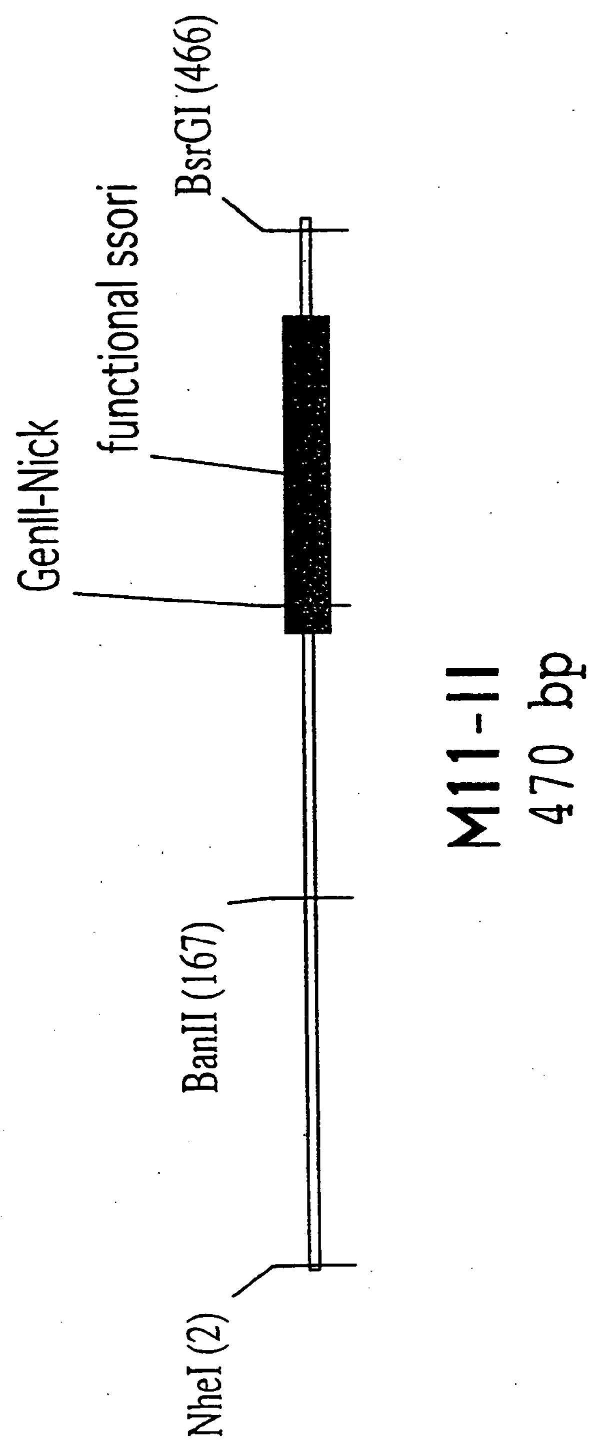



Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

**M11-II:**

```
       NheI
      ~~~~~~
  1   GCTAGCACGC GCCCTGTAGC GGCGCATTAA GCGCGGCGGG TGTGGTGGTT
      CGATCGTGCG CGGGACATCG CCGCGTAATT CGCGCCGCCC ACACCACCAA

 51   ACGCGCAGCG TGACCGCTAC ACTTGCCAGC GCCCTAGCGC CCGCTCCTTT
      TGCGCGTCGC ACTGGCGATG TGAACGGTCG CGGGATCGCG GGCGAGGAAA

101   CGCTTTCTTC CCTTCCTTTC TCGCCACGTT CGCCGGCTTT CCCCGTCAAG
      GCGAAAGAAG GGAAGGAAAG AGCGGTGCAA GCGGCCGAAA GGGGCAGTTC

                  BanII
                 ~~~~~~
151   CTCTAAATCG GGGGCTCCCT TTAGGGTTCC GATTTAGTGC TTTACGGCAC
      GAGATTTAGC CCCCGAGGGA AATCCCAAGG CTAAATCACG AAATGCCGTG

201   CTCGACCCCA AAAAACTTGA TTAGGGTGAT GGTTCTCGTA GTGGGCCATC
      GAGCTGGGGT TTTTTGAACT AATCCCACTA CCAAGAGCAT CACCCGGTAG

251   GCCCTGATAG ACGGTTTTTC GCCCTTTGAC GTTGGAGTCC ACGTTCTTTA
      CGGGACTATC TGCCAAAAAG CGGGAAACTG CAACCTCAGG TGCAAGAAAT
```

00412T0 "49006460

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
301  ATAGTGGACT CTTGTTCCAA ACTGGAACAA CACTCAACCC TATCTCGGTC
     TATCACCTGA GAACAAGGTT TGACCTTGTT GTGAGTTGGG ATAGAGCCAG

351  TATTCTTTTG ATTTATAAGG GATTTTGCCG ATTTCGGCCT ATTGGTTAAA
     ATAAGAAAAC TAAATATTCC CTAAAACGGC TAAAGCCGGA TAACCAATTT

401  AAATGAGCTG ATTTAACAAA AATTTAACGC GAATTTTAAC AAAATATTAA
     TTTACTCGAC TAAATTGTTT TTAAATTGCG CTTAAAATTG TTTTATAATT

                         BsrGI
                        ~~~~~~~
451  CGTTTACAAT TTCATGTACA
     GCAAATGTTA AAGTACATGT
```

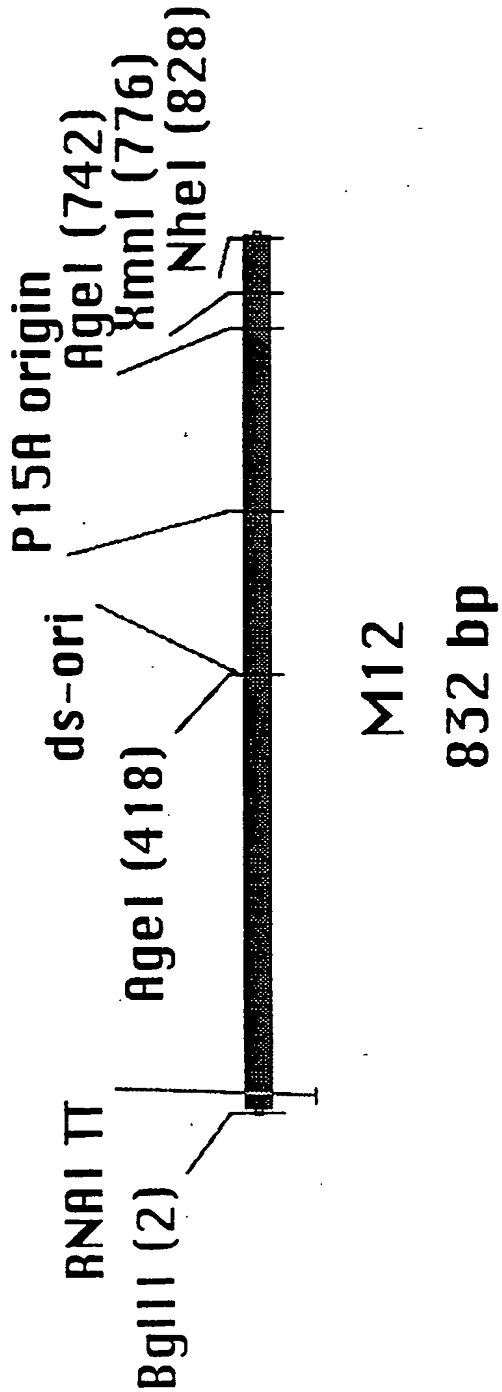



Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
M 12:
       BglII
      ~~~~~~~
  1    AGATCTAATA AGATGATCTT CTTGAGATCG TTTTGGTCTG CGCGTAATCT
       TCTAGATTAT TCTACTAGAA GAACTCTAGC AAAACCAGAC GCGCATTAGA

 51    CTTGCTCTGA AAACGAAAAA ACCGCCTTGC AGGGCGGTTT TTCGTAGGTT
       GAACGAGACT TTTGCTTTTT TGGCGGAACG TCCCGCCAAA AAGCATCCAA

101    CTCTGAGCTA CCAACTCTTT GAACCGAGGT AACTGGCTTG GAGGAGCGCA
       GAGACTCGAT GGTTGAGAAA CTTGGCTCCA TTGACCGAAC CTCCTCGCGT

151    GTCACTAAAA CTTGTCCTTT CAGTTTAGCC TTAACCGGCG CATGACTTCA
       CAGTGATTTT GAACAGGAAA GTCAAATCGG AATTGGCCGC GTACTGAAGT

201    AGACTAACTC CTCTAAATCA ATTACCAGTG GCTGCTGCCA GTGGTGCTTT
       TCTGATTGAG GAGATTTAGT TAATGGTCAC CGACGACGGT CACCACGAAA

251    TGCATGTCTT TCCGGGTTGG ACTCAAGACG ATAGTTACCG GATAAGGCGC
       ACGTACAGAA AGGCCCAACC TGAGTTCTGC TATCAATGGC CTATTCCGCG

301    AGCGGTCGGA CTGAACGGGG GGTTCGTGCA TACAGTCCAG CTTGGAGCGA
       TCGCCAGCCT GACTTGCCCC CCAAGCACGT ATGTCAGGTC GAACCTCGCT
```

00472T0 " 49006460

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
351  ACTGCCTACC CGGAACTGAG TGTCAGGCGT GGAATGAGAC AAACGCGGCC
     TGACGGATGG GCCTTGACTC ACAGTCCGCA CCTTACTCTG TTTGCGCCGG

                         AgeI
                       ~~~~~~~~
401  ATAACAGCGG AATGACACCG GTAAACCGAA AGGCAGGAAC AGGAGAGCGC
     TATTGTCGCC TTACTGTGGC CATTTGGCTT TCCGTCCTTG TCCTCTCGCG

451  AGGAGGGAGC CGCCAGGGGG AAACGCCTGG TATCTTTATA GTCCTGTCGG
     TCCTCCCTCG GCGGTCCCCC TTTGCGGACC ATAGAAATAT CAGGACAGCC

501  GTTTCGCCAC CACTGATTTG AGCGTCAGAT TTCGTGATGC TTGTCAGGGG
     CAAAGCGGTG GTGACTAAAC TCGCAGTCTA AAGCACTACG AACAGTCCCC

551  GGCGGAGCCT ATGGAAAAAC GGCTTTGCCG CGGCCCTCTC ACTTCCCTGT
     CCGCCTCGGA TACCTTTTTG CCGAAACGGC GCCGGGAGAG TGAAGGGACA

601  TAAGTATCTT CCTGGCATCT TCCAGGAAAT CTCCGCCCCG TTCGTAAGCC
     ATTCATAGAA GGACCGTAGA AGGTCCTTTA GAGGCGGGGC AAGCATTCGG

651  ATTTCCGCTC GCCGCAGTCG AACGACCGAG CGTAGCGAGT CAGTGAGCGA
     TAAAGGCGAG CGGCGTCAGC TTGCTGGCTC GCATCGCTCA GTCACTCGCT
```

00427014 9006460

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

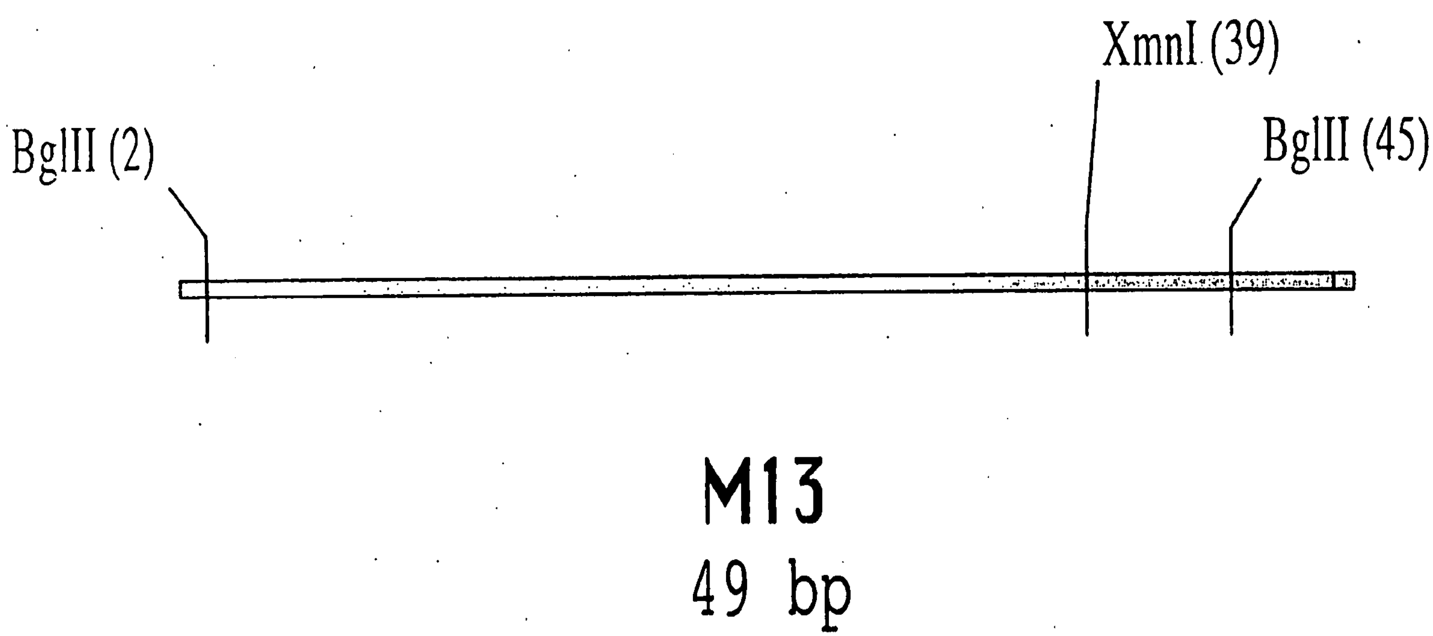
```
                                                          AgeI
                                                          ~~~~~~
701  GGAAGCGGAA TATATCCTGT ATCACATATT CTGCTGACGC ACCGGTGCAG
     CCTTCGCCTT ATATAGGACA TAGTGTATAA GACGACTGCG TGGCCACGTC

                                 XmnI
                            ~~~~~~~~~~~
751  CCTTTTTTCT CCTGCCACAT GAAGCACTTC ACTGACACCC TCATCAGTGC
     GGAAAAAAGA GGACGGTGTA CTTCGTGAAG TGACTGTGGG AGTAGTCACG

                                      NheI
                                    ~~~~~~
801  CAACATAGTA AGCCAGTATA CACTCCGCTA GC
     GTTGTATCAT TCGGTCATAT GTGAGGCGAT CG
```

00420.49006460

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)



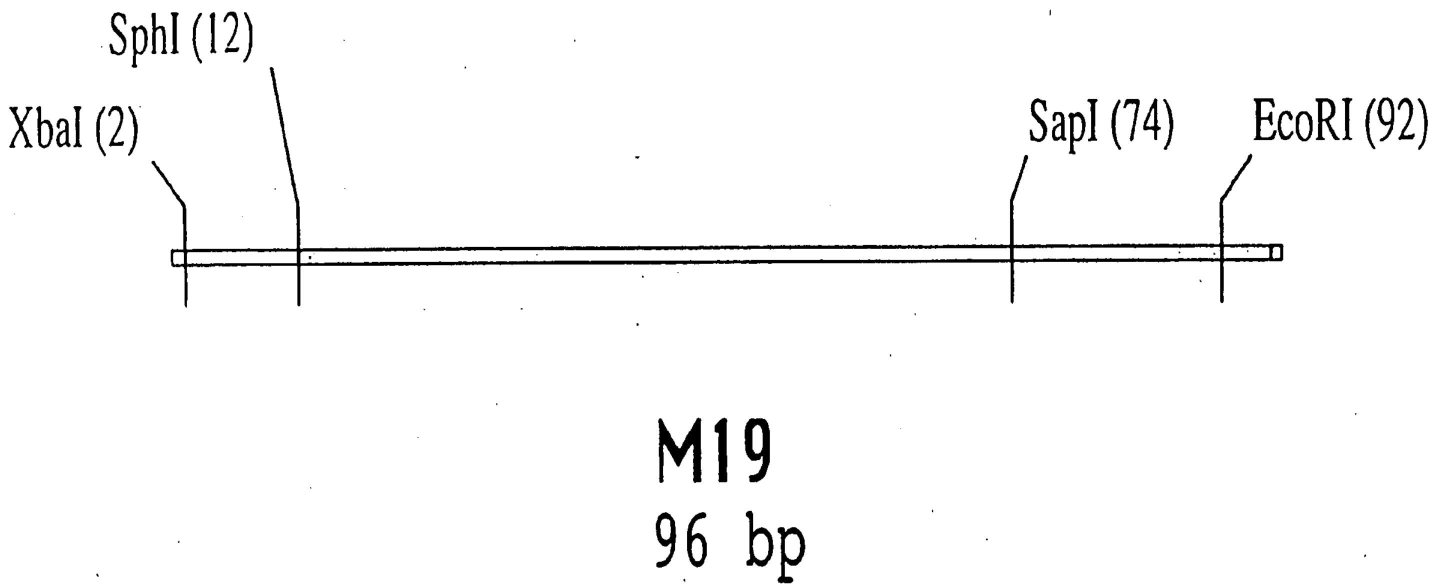
09006490 "07E400

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 13:

```
      BglII                                         XmnI      BglII
     ~~~~~~                                      ~~~~~~~~~~~~~~~~~~
1    AGATCTCATA ACTTCGTATA ATGTATGCTA TACGAAGTTA TTCAGATCT
     TCTAGAGTAT TGAAGCATAT TACATACGAT ATGCTTCAAT AAGTCTAGA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)



00h2T0" h9006h60

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 19:

```
       XbaI   SphI
      ~~~~~~~~~~~~~~
  1   TCTAGAGCAT GCGTAGGAGA AAATAAAATG AAACAAAGCA CTATTGCACT
      AGATCTCGTA CGCATCCTCT TTTATTTTAC TTTGTTTCGT GATAACGTGA

                     SapI                         EcoRI
                   ~~~~~~~~~                      ~~~~~~
 51   GGCACTCTTA CCGTTGCTCT TCACCCCTGT TACCAAAGCC GAATTC
      CCGTGAGAAT GGCAACGAGA AGTGGGGACA ATGGTTTCGG CTTAAG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

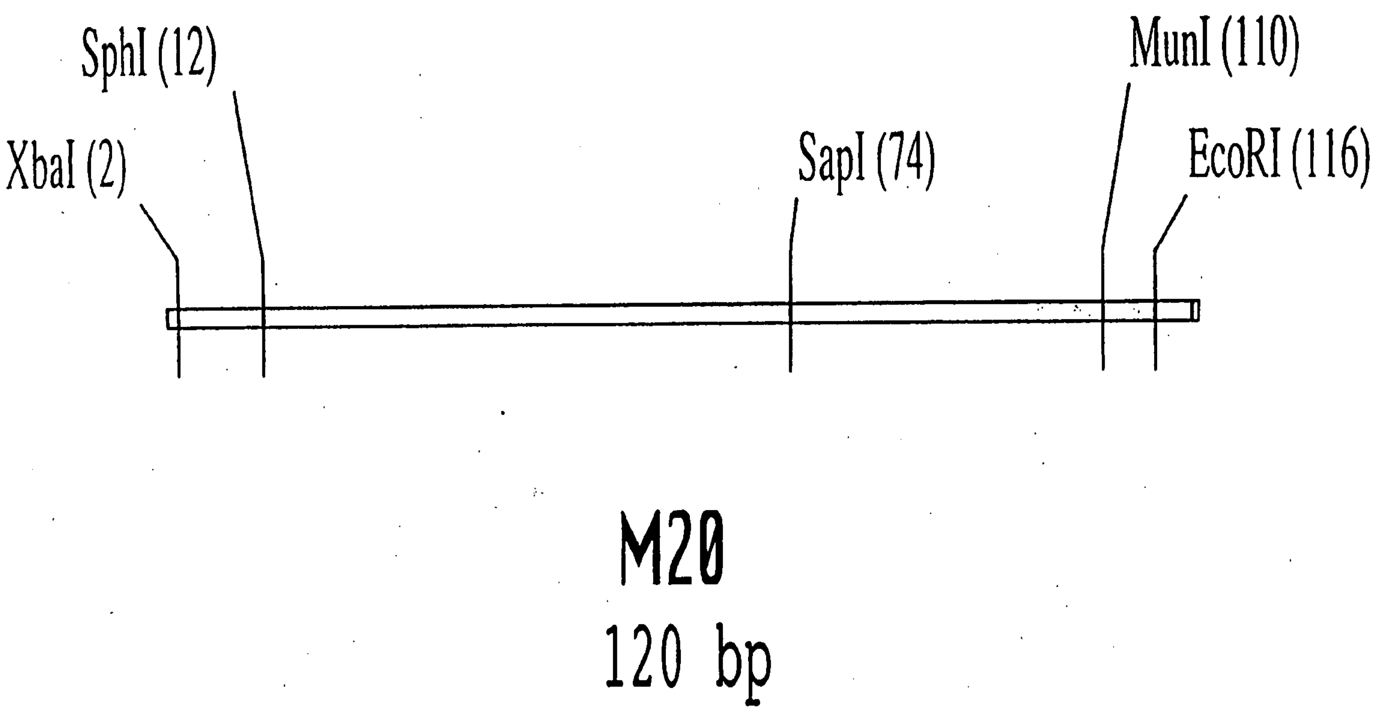


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 20:

```
         XbaI   SphI
         ~~~~~~~~~~~~~~
  1      TCTAGAGCAT GCGTAGGAGA AAATAAAATG AAACAAAGCA CTATTGCACT
         AGATCTCGTA CGCATCCTCT TTTATTTTAC TTTGTTTCGT GATAACGTGA

                              SapI
                            ~~~~~~~~~
 51      GGCACTCTTA CCGTTGCTCT TCACCCCTGT TACCAAAGCC GACTACAAAG
         CCGTGAGAAT GGCAACGAGA AGTGGGGACA ATGGTTTCGG CTGATGTTTC

                   MunI    EcoRI
                  ~~~~~~~~~~~~~~
101      ATGAAGTGCA ATTGGAATTC
         TACTTCACGT TAACCTTAAG
```

00420" 49006460

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

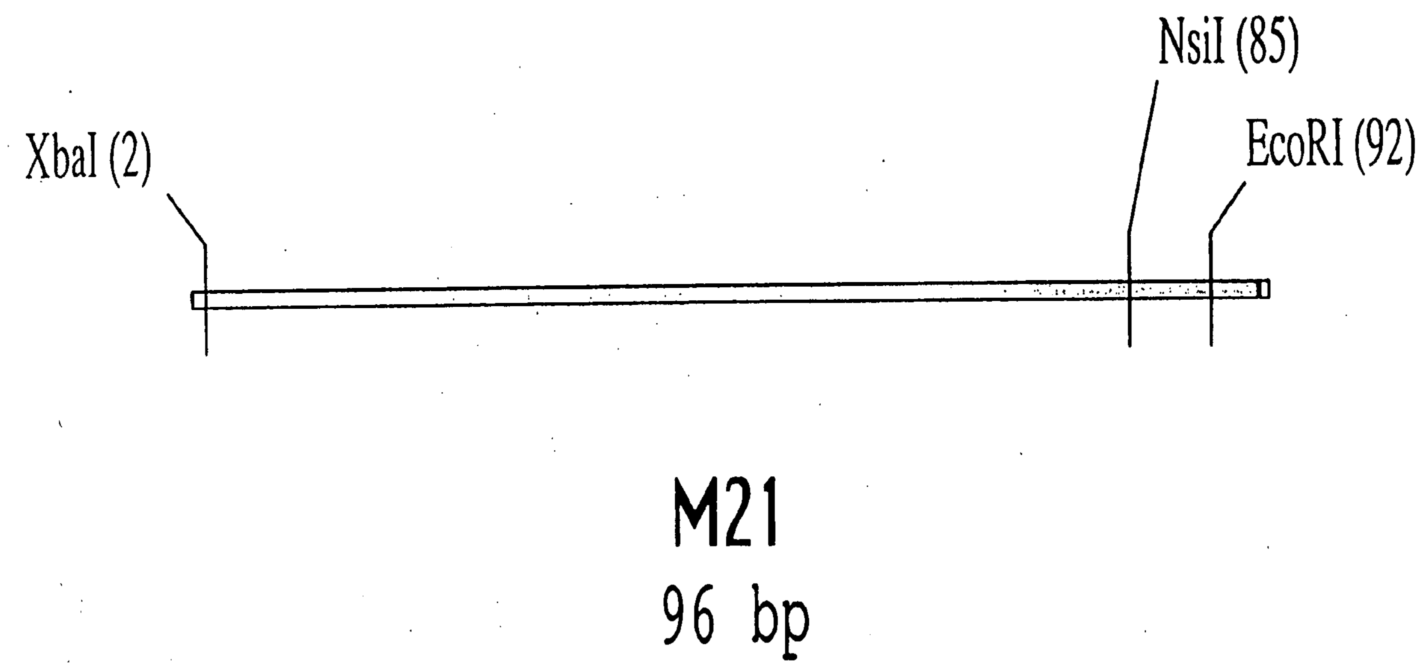


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 21:

```
     XbaI
    ~~~~~~
 1  TCTAGAGGTT GAGGTGATTT TATGAAAAAG AATATCGCAT TTCTTCTTGC
    AGATCTCCAA CTCCACTAAA ATACTTTTTC TTATAGCGTA AAGAAGAACG

                                     NsiI        EcoRI
                                   ~~~~~~~~     ~~~~~~
51  ATCTATGTTC GTTTTTTCTA TTGCTACAAA TGCATACGCT GAATTC
    TAGATACAAG CAAAAAAGAT AACGATGTTT ACGTATGCGA CTTAAG
```

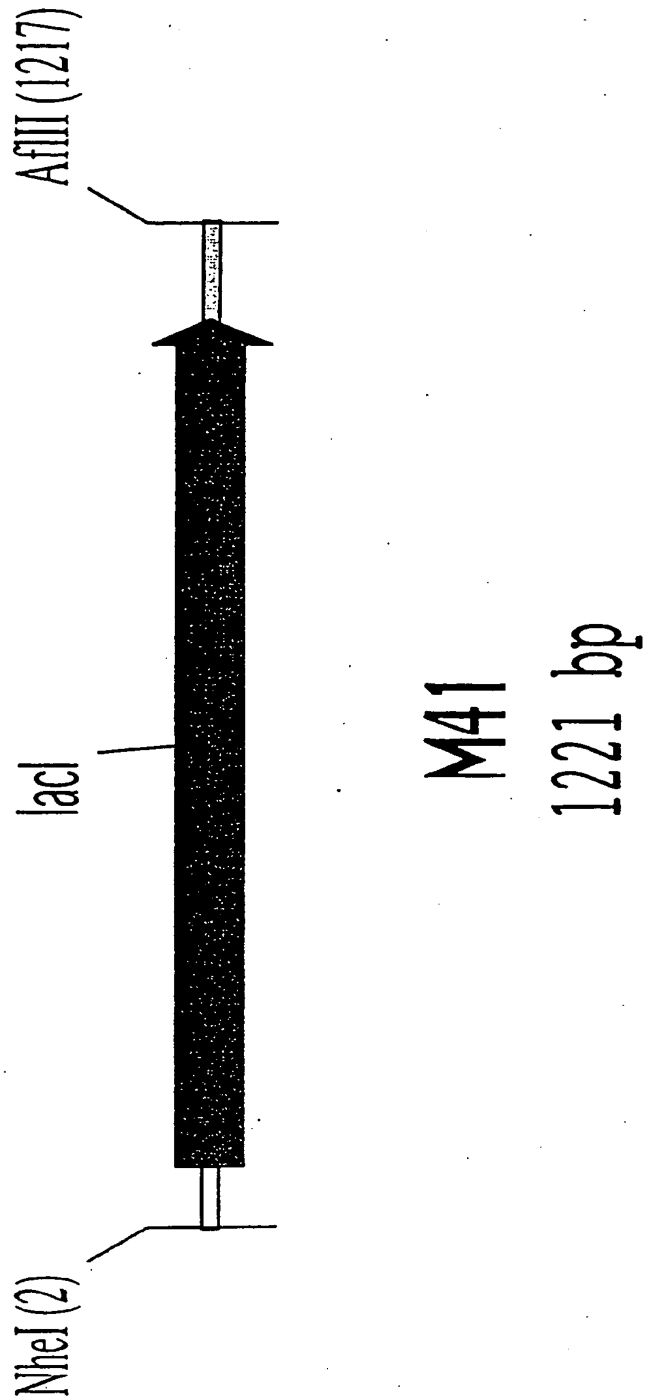



Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 41:

```
        NheI
        ~~~~~~
  1     GCTAGCATCG AATGGCGCAA AACCTTTCGC GGTATGGCAT GATAGCGCCC
        CGATCGTAGC TTACCGCGTT TTGGAAAGCG CCATACCGTA CTATCGCGGG

 51     GGAAGAGAGT CAATTCAGGG TGGTGAATGT GAAACCAGTA ACGTTATACG
        CCTTCTCTCA GTTAAGTCCC ACCACTTACA CTTTGGTCAT TGCAATATGC

101     ATGTCGCAGA GTATGCCGGT GTCTCTTATC AGACCGTTTC CCGCGTGGTG
        TACAGCGTCT CATACGGCCA CAGAGAATAG TCTGGCAAAG GGCGCACCAC

151     AACCAGGCCA GCCACGTTTC TGCGAAAACG CGGGAAAAAG TGGAAGCGGC
        TTGGTCCGGT CGGTGCAAAG ACGCTTTTGC GCCCTTTTTC ACCTTCGCCG

201     GATGGCGGAG CTGAATTACA TTCCTAACCG CGTGGCACAA CAACTGGCGG
        CTACCGCCTC GACTTAATGT AAGGATTGGC GCACCGTGTT GTTGACCGCC

251     GCAAACAGTC GTTGCTGATT GGCGTTGCCA CCTCCAGTCT GGCCCTGCAC
        CGTTTGTCAG CAACGACTAA CCGCAACGGT GGAGGTCAGA CCGGGACGTG

301     GCGCCGTCGC AAATTGTCGC GGCGATTAAA TCTCGCGCCG ATCAACTGGG
        CGCGGCAGCG TTTAACAGCG CCGCTAATTT AGAGCGCGGC TAGTTGACCC
```

09006490 . 012400

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
351  TGCCAGCGTG GTCGTGTCGA TGGTAGAACG AAGCGGCGTC GAAGCCTGTA
     ACGGTCGCAC CAGCACAGCT ACCATCTTGC TTCGCCGCAG CTTCGGACAT

401  AAGCGGCGGT GCACAATCTT CTCGCGCAAC GTGTCAGTGG GCTGATTATT
     TTCGCCGCCA CGTGTTAGAA GAGCGCGTTG CACAGTCACC CGACTAATAA

451  AACTATCCGC TGGATGACCA GGATGCTATT GCTGTGGAAG CTGCCTGCAC
     TTGATAGGCG ACCTACTGGT CCTACGATAA CGACACCTTC GACGGACGTG

501  TAATGTTCCG GCGTTATTTC TTGATGTCTC TGACCAGACA CCCATCAACA
     ATTACAAGGC CGCAATAAAG AACTACAGAG ACTGGTCTGT GGGTAGTTGT

551  GTATTATTTT CTCCCATGAG GACGGTACGC GACTGGGCGT GGAGCATCTG
     CATAATAAAA GAGGGTACTC CTGCCATGCG CTGACCCGCA CCTCGTAGAC

601  GTCGCATTGG GCCACCAGCA AATCGCGCTG TTAGCTGGCC CATTAAGTTC
     CAGCGTAACC CGGTGGTCGT TTAGCGCGAC AATCGACCGG GTAATTCAAG

651  TGTCTCGGCG CGTCTGCGTC TGGCTGGCTG GCATAAATAT CTCACTCGCA
     ACAGAGCCGC GCAGACGCAG ACCGACCGAC CGTATTTATA GAGTGAGCGT

701  ATCAAATTCA GCCGATAGCG GAACGGGAAG GCGACTGGAG TGCCATGTCC
     TAGTTTAAGT CGGCTATCGC CTTGCCCTTC CGCTGACCTC ACGGTACAGG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

| | | | | | |
|---|---|---|---|---|---|
| 751 | GGTTTTCAAC | AAACCATGCA | AATGCTGAAT | GAGGGCATCG | TTCCCACTGC |
| | CCAAAAGTTG | TTTGGTACGT | TTACGACTTA | CTCCCGTAGC | AAGGGTGACG |
| 801 | GATGCTGGTT | GCCAACGATC | AGATGGCGCT | GGGCGCAATG | CGTGCCATTA |
| | CTACGACCAA | CGGTTGCTAG | TCTACCGCGA | CCCGCGTTAC | GCACGGTAAT |
| 851 | CCGAGTCCGG | GCTGCGCGTT | GGTGCGGACA | TCTCGGTAGT | GGGATACGAC |
| | GGCTCAGGCC | CGACGCGCAA | CCACGCCTGT | AGAGCCATCA | CCCTATGCTG |
| 901 | GATACCGAGG | ACAGCTCATG | TTATATCCCG | CCGCTGACCA | CCATCAAACA |
| | CTATGGCTCC | TGTCGAGTAC | AATATAGGGC | GGCGACTGGT | GGTAGTTTGT |
| 951 | GGATTTTCGC | CTGCTGGGGC | AAACCAGCGT | GGACCGCTTG | CTGCAACTCT |
| | CCTAAAAGCG | GACGACCCCG | TTTGGTCGCA | CCTGGCGAAC | GACGTTGAGA |
| 1001 | CTCAGGGCCA | GGCGGTGAAG | GGCAATCAGC | TGTTGCCCGT | CTCACTGGTG |
| | GAGTCCCGGT | CCGCCACTTC | CCGTTAGTCG | ACAACGGGCA | GAGTGACCAC |
| 1051 | AAAAGAAAAA | CCACCCTGGC | TCCCAATACG | CAAACCGCCT | CTCCCCGCGC |
| | TTTTCTTTTT | GGTGGGACCG | AGGGTTATGC | GTTTGGCGGA | GAGGGGCGCG |
| 1101 | GTTGGCCGAT | TCACTGATGC | AGCTGGCACG | ACAGGTTTCC | CGACTGGAAA |
| | CAACCGGCTA | AGTGACTACG | TCGACCGTGC | TGTCCAAAGG | GCTGACCTTT |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
1151   GCGGGCAGTG AGGCTACCCG ATAAAAGCGG CTTCCTGACA GGAGGCCGTT
       CGCCCGTCAC TCCGATGGGC TATTTTCGCC GAAGGACTGT CCTCCGGCAA

                              AflII
                             ~~~~~~
1201   TTGTTTTGCA GCCCACTTAA G
       AACAAAACGT CGGGTGAATT C
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

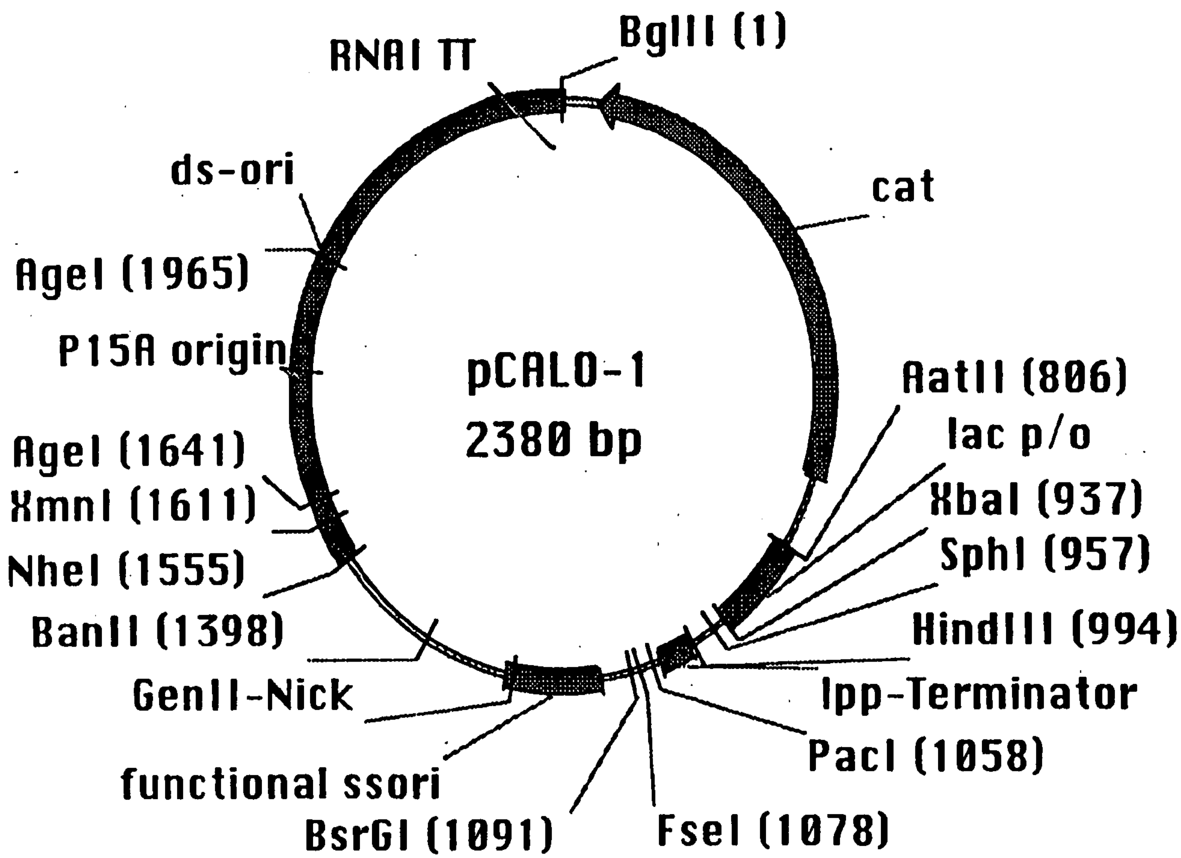


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

pCAL0-1:

```
     BglII
     ~~~~~
  1  GATCTAGCAC CAGGCGTTTA AGGGCACCAA TAACTGCCTT AAAAAAATTA
     CTAGATCGTG GTCCGCAAAT TCCCGTGGTT ATTGACGGAA TTTTTTTAAT

 51  CGCCCCGCCC TGCCACTCAT CGCAGTACTG TTGTAATTCA TTAAGCATTC
     GCGGGGCGGG ACGGTGAGTA GCGTCATGAC AACATTAAGT AATTCGTAAG

101  TGCCGACATG GAAGCCATCA CAAACGGCAT GATGAACCTG AATCGCCAGC
     ACGGCTGTAC CTTCGGTAGT GTTTGCCGTA CTACTTGGAC TTAGCGGTCG

151  GGCATCAGCA CCTTGTCGCC TTGCGTATAA TATTTGCCCA TAGTGAAAAC
     CCGTAGTCGT GGAACAGCGG AACGCATATT ATAAACGGGT ATCACTTTTG

201  GGGGGCGAAG AAGTTGTCCA TATTGGCTAC GTTTAAATCA AAACTGGTGA
     CCCCCGCTTC TTCAACAGGT ATAACCGATG CAAATTTAGT TTTGACCACT

251  AACTCACCCA GGGATTGGCT GAGACGAAAA ACATATTCTC AATAAACCCT
     TTGAGTGGGT CCCTAACCGA CTCTGCTTTT TGTATAAGAG TTATTTGGGA

301  TTAGGGAAAT AGGCCAGGTT TTCACCGTAA CACGCCACAT CTTGCGAATA
     AATCCCTTTA TCCGGTCCAA AAGTGGCATT GTGCGGTGTA GAACGCTTAT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
351  TATGTGTAGA AACTGCCGGA AATCGTCGTG GTATTCACTC CAGAGCGATG
     ATACACATCT TTGACGGCCT TTAGCAGCAC CATAAGTGAG GTCTCGCTAC

401  AAAACGTTTC AGTTTGCTCA TGGAAAACGG TGTAACAAGG GTGAACACTA
     TTTTGCAAAG TCAAACGAGT ACCTTTTGCC ACATTGTTCC CACTTGTGAT

451  TCCCATATCA CCAGCTCACC GTCTTTCATT GCCATACGGA ACTCCGGGTG
     AGGGTATAGT GGTCGAGTGG CAGAAAGTAA CGGTATGCCT TGAGGCCCAC

501  AGCATTCATC AGGCGGGCAA GAATGTGAAT AAAGGCCGGA TAAAACTTGT
     TCGTAAGTAG TCCGCCCGTT CTTACACTTA TTTCCGGCCT ATTTTGAACA

551  GCTTATTTTT CTTTACGGTC TTTAAAAAGG CCGTAATATC CAGCTGAACG
     CGAATAAAAA GAAATGCCAG AAATTTTTCC GGCATTATAG GTCGACTTGC

601  GTCTGGTTAT AGGTACATTG AGCAACTGAC TGAAATGCCT CAAAATGTTC
     CAGACCAATA TCCATGTAAC TCGTTGACTG ACTTTACGGA GTTTTACAAG

651  TTTACGATGC CATTGGGATA TATCAACGGT GGTATATCCA GTGATTTTTT
     AAATGCTACG GTAACCCTAT ATAGTTGCCA CCATATAGGT CACTAAAAAA

701  TCTCCATTTT AGCTTCCTTA GCTCCTGAAA ATCTCGATAA CTCAAAAAAT
     AGAGGTAAAA TCGAAGGAAT CGAGGACTTT TAGAGCTATT GAGTTTTTTA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
751   ACGCCCGGTA GTGATCTTAT TTCATTATGG TGAAAGTTGG AACCTCACCC
      TGCGGGCCAT CACTAGAATA AAGTAATACC ACTTTCAACC TTGGAGTGGG

       AatII
      ~~~~~~~
801   GACGTCTAAT GTGAGTTAGC TCACTCATTA GGCACCCCAG GCTTTACACT
      CTGCAGATTA CACTCAATCG AGTGAGTAAT CCGTGGGGTC CGAAATGTGA

851   TTATGCTTCC GGCTCGTATG TTGTGTGGAA TTGTGAGCGG ATAACAATTT
      AATACGAAGG CCGAGCATAC AACACACCTT AACACTCGCC TATTGTTAAA

                                           XbaI
                                         ~~~~~~~~
901   CACACAGGAA ACAGCTATGA CCATGATTAC GAATTTCTAG ACCCCCCCCC
      GTGTGTCCTT TGTCGATACT GGTACTAATG CTTAAAGATC TGGGGGGGGG

        SphI                                        HindIII
       ~~~~~~                                       ~~~~~~
951   CGCATGCCAT AACTTCGTAT AATGTACGCT ATACGAAGTT ATAAGCTTGA
      GCGTACGGTA TTGAAGCATA TTACATGCGA TATGCTTCAA TATTCGAACT

1001  CCTGTGAAGT GAAAAATGGC GCAGATTGTG CGACATTTTT TTTGTCTGCC
      GGACACTTCA CTTTTTACCG CGTCTAACAC GCTGTAAAAA AAACAGACGG
```

00h2T0" h9006h60

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
              PacI                           FseI                       BsrGI
            ~~~~~~~~~                     ~~~~~~~~~                   ~~~~~~~~
1051  GTTTAATTAA AGGGGGGGGG GGGCCGGCCT GGGGGGGGGT GTACATGAAA
      CAAATTAATT TCCCCCCCCC CCCGGCCGGA CCCCCCCCCA CATGTACTTT

1101  TTGTAAACGT TAATATTTTG TTAAAATTCG CGTTAAATTT TTGTTAAATC
      AACATTTGCA ATTATAAAAC AATTTTAAGC GCAATTTAAA AACAATTTAG

1151  AGCTCATTTT TTAACCAATA GGCCGAAATC GGCAAAATCC CTTATAAATC
      TCGAGTAAAA AATTGGTTAT CCGGCTTTAG CCGTTTTAGG GAATATTTAG

1201  AAAAGAATAG ACCGAGATAG GGTTGAGTGT TGTTCCAGTT TGGAACAAGA
      TTTTCTTATC TGGCTCTATC CCAACTCACA ACAAGGTCAA ACCTTGTTCT

1251  GTCCACTATT AAAGAACGTG GACTCCAACG TCAAAGGGCG AAAAACCGTC
      CAGGTGATAA TTTCTTGCAC CTGAGGTTGC AGTTTCCCGC TTTTTGGCAG

1301  TATCAGGGCG ATGGCCCACT ACGAGAACCA TCACCCTAAT CAAGTTTTTT
      ATAGTCCCGC TACCGGGTGA TGCTCTTGGT AGTGGGATTA GTTCAAAAAA

                                                           BanII
                                                          ~~~~~~
1351  GGGGTCGAGG TGCCGTAAAG CACTAAATCG GAACCCTAAA GGGAGCCCCC
      CCCCAGCTCC ACGGCATTTC GTGATTTAGC CTTGGGATTT CCCTCGGGGG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
1401   GATTTAGAGC TTGACGGGGA AAGCCGGCGA ACGTGGCGAG AAAGGAAGGG
       CTAAATCTCG AACTGCCCCT TTCGGCCGCT TGCACCGCTC TTTCCTTCCC

1451   AAGAAAGCGA AAGGAGCGGG CGCTAGGGCG CTGGCAAGTG TAGCGGTCAC
       TTCTTTCGCT TTCCTCGCCC GCGATCCCGC GACCGTTCAC ATCGCCAGTG

1501   GCTGCGCGTA ACCACCACAC CCGCCGCGCT TAATGCGCCG CTACAGGGCG
       CGACGCGCAT TGGTGGTGTG GGCGGCGCGA ATTACGCGGC GATGTCCCGC

          NheI
         ~~~~~~~
1551   CGTGCTAGCG GAGTGTATAC TGGCTTACTA TGTTGGCACT GATGAGGGTG
       GCACGATCGC CTCACATATG ACCGAATGAT ACAACCGTGA CTACTCCCAC

                XmnI                              AgeI
           ~~~~~~~~~~~~                          ~~~~~~~~
1601   TCAGTGAAGT GCTTCATGTG GCAGGAGAAA AAAGGCTGCA CCGGTGCGTC
       AGTCACTTCA CGAAGTACAC CGTCCTCTTT TTTCCGACGT GGCCACGCAG

1651   AGCAGAATAT GTGATACAGG ATATATTCCG CTTCCTCGCT CACTGACTCG
       TCGTCTTATA CACTATGTCC TATATAAGGC GAAGGAGCGA GTGACTGAGC

1701   CTACGCTCGG TCGTTCGACT GCGGCGAGCG GAAATGGCTT ACGAACGGGG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
     GATGCGAGCC AGCAAGCTGA CGCCGCTCGC CTTTACCGAA TGCTTGCCCC

1751 CGGAGATTTC CTGGAAGATG CCAGGAAGAT ACTTAACAGG GAAGTGAGAG
     GCCTCTAAAG GACCTTCTAC GGTCCTTCTA TGAATTGTCC CTTCACTCTC

1801 GGCCGCGGCA AAGCCGTTTT TCCATAGGCT CCGCCCCCCT GACAAGCATC
     CCGGCGCCGT TTCGGCAAAA AGGTATCCGA GGCGGGGGGA CTGTTCGTAG

1851 ACGAAATCTG ACGCTCAAAT CAGTGGTGGC GAAACCCGAC AGGACTATAA
     TGCTTTAGAC TGCGAGTTTA GTCACCACCG CTTTGGGCTG TCCTGATATT

1901 AGATACCAGG CGTTTCCCCC TGGCGGCTCC CTCCTGCGCT CTCCTGTTCC
     TCTATGGTCC GCAAAGGGGG ACCGCCGAGG GAGGACGCGA GAGGACAAGG

                   AgeI
                  ~~~~~~~
1951 TGCCTTTCGG TTTACCGGTG TCATTCCGCT GTTATGGCCG CGTTTGTCTC
     ACGGAAAGCC AAATGGCCAC AGTAAGGCGA CAATACCGGC GCAAACAGAG

2001 ATTCCACGCC TGACACTCAG TTCCGGGTAG GCAGTTCGCT CCAAGCTGGA
     TAAGGTGCGG ACTGTGAGTC AAGGCCCATC CGTCAAGCGA GGTTCGACCT

2051 CTGTATGCAC GAACCCCCCG TTCAGTCCGA CCGCTGCGCC TTATCCGGTA
     GACATACGTG CTTGGGGGGC AAGTCAGGCT GGCGACGCGG AATAGGCCAT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
2101  ACTATCGTCT TGAGTCCAAC CCGGAAAGAC ATGCAAAAGC ACCACTGGCA
      TGATAGCAGA ACTCAGGTTG GGCCTTTCTG TACGTTTTCG TGGTGACCGT

2151  GCAGCCACTG GTAATTGATT TAGAGGAGTT AGTCTTGAAG TCATGCGCCG
      CGTCGGTGAC CATTAACTAA ATCTCCTCAA TCAGAACTTC AGTACGCGGC

2201  GTTAAGGCTA AACTGAAAGG ACAAGTTTTA GTGACTGCGC TCCTCCAAGC
      CAATTCCGAT TTGACTTTCC TGTTCAAAAT CACTGACGCG AGGAGGTTCG

2251  CAGTTACCTC GGTTCAAAGA GTTGGTAGCT CAGAGAACCT ACGAAAAACC
      GTCAATGGAG CCAAGTTTCT CAACCATCGA GTCTCTTGGA TGCTTTTTGG

2301  GCCCTGCAAG GCGGTTTTTT CGTTTTCAGA GCAAGAGATT ACGCGCAGAC
      CGGGACGTTC CGCCAAAAAA GCAAAAGTCT CGTTCTCTAA TGCGCGTCTG

                                 BglII
                                     ~
2351  CAAAACGATC TCAAGAAGAT CATCTTATTA
      GTTTTGCTAG AGTTCTTCTA GTAGAATAAT
```

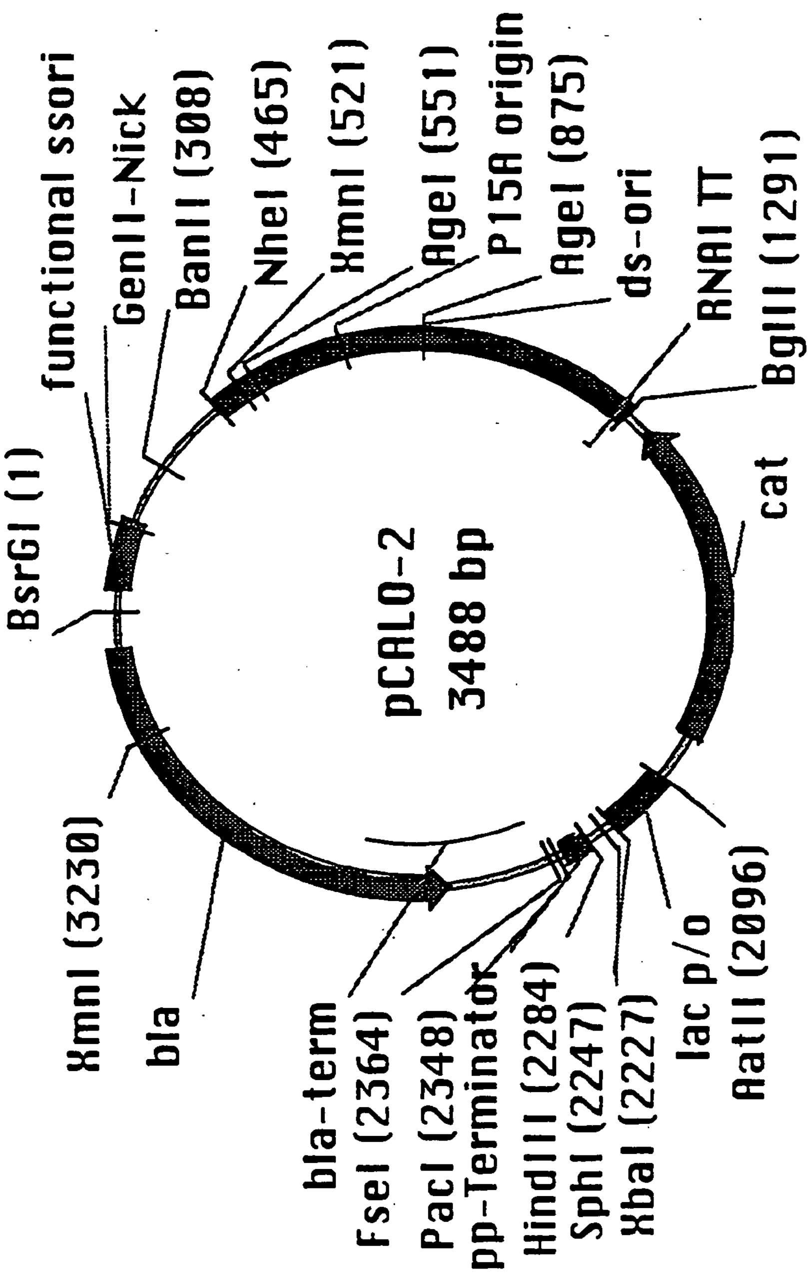



Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

## pCALO-2:

```
      BsrGI
      ~~~~~
  1   GTACATGAAA TTGTAAACGT TAATATTTTG TTAAAATTCG CGTTAAATTT
      CATGTACTTT AACATTTGCA ATTATAAAAC AATTTTAAGC GCAATTTAAA

 51   TTGTTAAATC AGCTCATTTT TTAACCAATA GGCCGAAATC GGCAAAATCC
      AACAATTTAG TCGAGTAAAA AATTGGTTAT CCGGCTTTAG CCGTTTTAGG

101   CTTATAAATC AAAAGAATAG ACCGAGATAG GGTTGAGTGT TGTTCCAGTT
      GAATATTTAG TTTTCTTATC TGGCTCTATC CCAACTCACA ACAAGGTCAA

151   TGGAACAAGA GTCCACTATT AAAGAACGTG GACTCCAACG TCAAAGGGCG
      ACCTTGTTCT CAGGTGATAA TTTCTTGCAC CTGAGGTTGC AGTTTCCCGC

201   AAAAACCGTC TATCAGGGCG ATGGCCCACT ACGAGAACCA TCACCCTAAT
      TTTTTGGCAG ATAGTCCCGC TACCGGGTGA TGCTCTTGGT AGTGGGATTA

251   CAAGTTTTTT GGGGTCGAGG TGCCGTAAAG CACTAAATCG GAACCCTAAA
      GTTCAAAAAA CCCCAGCTCC ACGGCATTTC GTGATTTAGC CTTGGGATTT

        BanII
        ~~~~~~
301   GGGAGCCCCC GATTTAGAGC TTGACGGGGA AAGCCGGCGA ACGTGGCGAG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
     CCCTCGGGGG CTAAATCTCG AACTGCCCCT TTCGGCCGCT TGCACCGCTC

351  AAAGGAAGGG AAGAAAGCGA AAGGAGCGGG CGCTAGGGCG CTGGCAAGTG
     TTTCCTTCCC TTCTTTCGCT TTCCTCGCCC GCGATCCCGC GACCGTTCAC

401  TAGCGGTCAC GCTGCGCGTA ACCACCACAC CCGCCGCGCT TAATGCGCCG
     ATCGCCAGTG CGACGCGCAT TGGTGGTGTG GGCGGCGCGA ATTACGCGGC

                 NheI
                ~~~~~~
451  CTACAGGGCG CGTGCTAGCG GAGTGTATAC TGGCTTACTA TGTTGGCACT
     GATGTCCCGC GCACGATCGC CTCACATATG ACCGAATGAT ACAACCGTGA

                      XmnI                             AgeI
                  ~~~~~~~~~~~~                            ~
501  GATGAGGGTG TCAGTGAAGT GCTTCATGTG GCAGGAGAAA AAAGGCTGCA
     CTACTCCCAC AGTCACTTCA CGAAGTACAC CGTCCTCTTT TTTCCGACGT

     AgeI
     ~~~~~
551  CCGGTGCGTC AGCAGAATAT GTGATACAGG ATATATTCCG CTTCCTCGCT
     GGCCACGCAG TCGTCTTATA CACTATGTCC TATATAAGGC GAAGGAGCGA

601  CACTGACTCG CTACGCTCGG TCGTTCGACT GCGGCGAGCG GAAATGGCTT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
     GTGACTGAGC GATGCGAGCC AGCAAGCTGA CGCCGCTCGC CTTTACCGAA

651  ACGAACGGGG CGGAGATTTC CTGGAAGATG CCAGGAAGAT ACTTAACAGG
     TGCTTGCCCC GCCTCTAAAG GACCTTCTAC GGTCCTTCTA TGAATTGTCC

701  GAAGTGAGAG GGCCGCGGCA AAGCCGTTTT TCCATAGGCT CCGCCCCCCT
     CTTCACTCTC CCGGCGCCGT TTCGGCAAAA AGGTATCCGA GGCGGGGGGA

751  GACAAGCATC ACGAAATCTG ACGCTCAAAT CAGTGGTGGC GAAACCCGAC
     CTGTTCGTAG TGCTTTAGAC TGCGAGTTTA GTCACCACCG CTTTGGGCTG

801  AGGACTATAA AGATACCAGG CGTTTCCCCC TGGCGGCTCC CTCCTGCGCT
     TCCTGATATT TCTATGGTCC GCAAAGGGGG ACCGCCGAGG GAGGACGCGA

                                AgeI
                               ~~~~~~
851  CTCCTGTTCC TGCCTTTCGG TTTACCGGTG TCATTCCGCT GTTATGGCCG
     GAGGACAAGG ACGGAAAGCC AAATGGCCAC AGTAAGGCGA CAATACCGGC

901  CGTTTGTCTC ATTCCACGCC TGACACTCAG TTCCGGGTAG GCAGTTCGCT
     GCAAACAGAG TAAGGTGCGG ACTGTGAGTC AAGGCCCATC CGTCAAGCGA

951  CCAAGCTGGA CTGTATGCAC GAACCCCCCG TTCAGTCCGA CCGCTGCGCC
     GGTTCGACCT GACATACGTG CTTGGGGGGC AAGTCAGGCT GGCGACGCGG
```

00427O" 49006460

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
1001  TTATCCGGTA ACTATCGTCT TGAGTCCAAC CCGGAAAGAC ATGCAAAAGC
      AATAGGCCAT TGATAGCAGA ACTCAGGTTG GGCCTTTCTG TACGTTTTCG

1051  ACCACTGGCA GCAGCCACTG GTAATTGATT TAGAGGAGTT AGTCTTGAAG
      TGGTGACCGT CGTCGGTGAC CATTAACTAA ATCTCCTCAA TCAGAACTTC

1101  TCATGCGCCG GTTAAGGCTA AACTGAAAGG ACAAGTTTTA GTGACTGCGC
      AGTACGCGGC CAATTCCGAT TTGACTTTCC TGTTCAAAAT CACTGACGCG

1151  TCCTCCAAGC CAGTTACCTC GGTTCAAAGA GTTGGTAGCT CAGAGAACCT
      AGGAGGTTCG GTCAATGGAG CCAAGTTTCT CAACCATCGA GTCTCTTGGA

1201  ACGAAAAACC GCCCTGCAAG GCGGTTTTTT CGTTTTCAGA GCAAGAGATT
      TGCTTTTTGG CGGGACGTTC CGCCAAAAAA GCAAAAGTCT CGTTCTCTAA

                                                 BglII
                                               ~~~~~~~~
1251  ACGCGCAGAC CAAAACGATC TCAAGAAGAT CATCTTATTA GATCTAGCAC
      TGCGCGTCTG GTTTTGCTAG AGTTCTTCTA GTAGAATAAT CTAGATCGTG

1301  CAGGCGTTTA AGGGCACCAA TAACTGCCTT AAAAAAATTA CGCCCCGCCC
      GTCCGCAAAT TCCCGTGGTT ATTGACGGAA TTTTTTTAAT GCGGGGCGGG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
1351   TGCCACTCAT CGCAGTACTG TTGTAATTCA TTAAGCATTC TGCCGACATG
       ACGGTGAGTA GCGTCATGAC AACATTAAGT AATTCGTAAG ACGGCTGTAC

1401   GAAGCCATCA CAAACGGCAT GATGAACCTG AATCGCCAGC GGCATCAGCA
       CTTCGGTAGT GTTTGCCGTA CTACTTGGAC TTAGCGGTCG CCGTAGTCGT

1451   CCTTGTCGCC TTGCGTATAA TATTTGCCCA TAGTGAAAAC GGGGGCGAAG
       GGAACAGCGG AACGCATATT ATAAACGGGT ATCACTTTTG CCCCCGCTTC

1501   AAGTTGTCCA TATTGGCTAC GTTTAAATCA AAACTGGTGA AACTCACCCA
       TTCAACAGGT ATAACCGATG CAAATTTAGT TTTGACCACT TTGAGTGGGT

1551   GGGATTGGCT GAGACGAAAA ACATATTCTC AATAAACCCT TTAGGGAAAT
       CCCTAACCGA CTCTGCTTTT TGTATAAGAG TTATTTGGGA AATCCCTTTA

1601   AGGCCAGGTT TTCACCGTAA CACGCCACAT CTTGCGAATA TATGTGTAGA
       TCCGGTCCAA AAGTGGCATT GTGCGGTGTA GAACGCTTAT ATACACATCT

1651   AACTGCCGGA AATCGTCGTG GTATTCACTC CAGAGCGATG AAAACGTTTC
       TTGACGGCCT TTAGCAGCAC CATAAGTGAG GTCTCGCTAC TTTTGCAAAG

1701   AGTTTGCTCA TGGAAAACGG TGTAACAAGG GTGAACACTA TCCCATATCA
       TCAAACGAGT ACCTTTTGCC ACATTGTTCC CACTTGTGAT AGGGTATAGT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
1751   CCAGCTCACC GTCTTTCATT GCCATACGGA ACTCCGGGTG AGCATTCATC
       GGTCGAGTGG CAGAAAGTAA CGGTATGCCT TGAGGCCCAC TCGTAAGTAG

1801   AGGCGGGCAA GAATGTGAAT AAAGGCCGGA TAAAACTTGT GCTTATTTTT
       TCCGCCCGTT CTTACACTTA TTTCCGGCCT ATTTTGAACA CGAATAAAAA

1851   CTTTACGGTC TTTAAAAAGG CCGTAATATC CAGCTGAACG GTCTGGTTAT
       GAAATGCCAG AAATTTTTCC GGCATTATAG GTCGACTTGC CAGACCAATA

1901   AGGTACATTG AGCAACTGAC TGAAATGCCT CAAAATGTTC TTTACGATGC
       TCCATGTAAC TCGTTGACTG ACTTTACGGA GTTTTACAAG AAATGCTACG

1951   CATTGGGATA TATCAACGGT GGTATATCCA GTGATTTTTT TCTCCATTTT
       GTAACCCTAT ATAGTTGCCA CCATATAGGT CACTAAAAAA AGAGGTAAAA

2001   AGCTTCCTTA GCTCCTGAAA ATCTCGATAA CTCAAAAAAT ACGCCCGGTA
       TCGAAGGAAT CGAGGACTTT TAGAGCTATT GAGTTTTTTA TGCGGGCCAT

                                                 AatII
                                                 ~~~~~~
2051   GTGATCTTAT TTCATTATGG TGAAAGTTGG AACCTCACCC GACGTCTAAT
       CACTAGAATA AAGTAATACC ACTTTCAACC TTGGAGTGGG CTGCAGATTA

2101   GTGAGTTAGC TCACTCATTA GGCACCCCAG GCTTTACACT TTATGCTTCC
```

00423013.049006

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
       CACTCAATCG AGTGAGTAAT CCGTGGGGTC CGAAATGTGA AATACGAAGG

2151   GGCTCGTATG TTGTGTGGAA TTGTGAGCGG ATAACAATTT CACACAGGAA
       CCGAGCATAC AACACACCTT AACACTCGCC TATTGTTAAA GTGTGTCCTT

                                  XbaI                SphI
                                ~~~~~~~~             ~~~~~~~
2201   ACAGCTATGA CCATGATTAC GAATTTCTAG ACCCCCCCCC CGCATGCCAT
       TGTCGATACT GGTACTAATG CTTAAAGATC TGGGGGGGGG GCGTACGGTA

                                             HindIII
                                             ~~~~~~~
2251   AACTTCGTAT AATGTACGCT ATACGAAGTT ATAAGCTTGA CCTGTGAAGT
       TTGAAGCATA TTACATGCGA TATGCTTCAA TATTCGAACT GGACACTTCA

                                                        PacI
                                                     ~~~~~~~~~
2301   GAAAAATGGC GCAGATTGTG CGACATTTTT TTTGTCTGCC GTTTAATTAA
       CTTTTTACCG CGTCTAACAC GCTGTAAAAA AAACAGACGG CAAATTAATT

             FseI
         ~~~~~~~~~~
2351   GGGGGGGGGC CGGCCATTAT CAAAAAGGAT CTCAAGAAGA TCCTTTGATC
       CCCCCCCCCG GCCGGTAATA GTTTTTCCTA GAGTTCTTCT AGGAAACTAG
```

00h2T0" h9006h60

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
2401  TTTTCTACGG GGTCTGACGC TCAGTGGAAC GAAAACTCAC GTTAAGGGAT
      AAAAGATGCC CCAGACTGCG AGTCACCTTG CTTTTGAGTG CAATTCCCTA

2451  TTTGGTCATG AGATTATCAA AAAGGATCTT CACCTAGATC CTTTTAAATT
      AAACCAGTAC TCTAATAGTT TTTCCTAGAA GTGGATCTAG GAAAATTTAA

2501  AAAAATGAAG TTTTAAATCA ATCTAAAGTA TATATGAGTA AACTTGGTCT
      TTTTTACTTC AAAATTTAGT TAGATTTCAT ATATACTCAT TTGAACCAGA

2551  GACAGTTACC CAATGCTTAA TCAGTGAGGC ACCTATCTCA GCGATCTGTC
      CTGTCAATGG GTTACGAATT AGTCACTCCG TGGATAGAGT CGCTAGACAG

2601  TATTTCGTTC ATCCATAGTT GCCTGACTCC CCGTCGTGTA GATAACTACG
      ATAAAGCAAG TAGGTATCAA CGGACTGAGG GGCAGCACAT CTATTGATGC

2651  ATACGGGAGG GCTTACCATC TGGCCCCAGT GCTGCAATGA TACCGCGAGA
      TATGCCCTCC CGAATGGTAG ACCGGGGTCA CGACGTTACT ATGGCGCTCT

2701  CCCACGCTCA CCGGCTCCAG ATTTATCAGC AATAAACCAG CCAGCCGGAA
      GGGTGCGAGT GGCCGAGGTC TAAATAGTCG TTATTTGGTC GGTCGGCCTT

2751  GGGCCGAGCG CAGAAGTGGT CCTGCAACTT TATCCGCCTC CATCCAGTCT
      CCCGGCTCGC GTCTTCACCA GGACGTTGAA ATAGGCGGAG GTAGGTCAGA
```

00420 " 49006460

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
2801  ATTAACTGTT GCCGGGAAGC TAGAGTAAGT AGTTCGCCAG TTAATAGTTT
      TAATTGACAA CGGCCCTTCG ATCTCATTCA TCAAGCGGTC AATTATCAAA

2851  GCGCAACGTT GTTGCCATTG CTACAGGCAT CGTGGTGTCA CGCTCGTCGT
      CGCGTTGCAA CAACGGTAAC GATGTCCGTA GCACCACAGT GCGAGCAGCA

2901  TTGGTATGGC TTCATTCAGC TCCGGTTCCC AACGATCAAG GCGAGTTACA
      AACCATACCG AAGTAAGTCG AGGCCAAGGG TTGCTAGTTC CGCTCAATGT

2951  TGATCCCCCA TGTTGTGCAA AAAAGCGGTT AGCTCCTTCG GTCCTCCGAT
      ACTAGGGGGT ACAACACGTT TTTTCGCCAA TCGAGGAAGC CAGGAGGCTA

3001  CGTTGTCAGA AGTAAGTTGG CCGCAGTGTT ATCACTCATG GTTATGGCAG
      GCAACAGTCT TCATTCAACC GGCGTCACAA TAGTGAGTAC CAATACCGTC

3051  CACTGCATAA TTCTCTTACT GTCATGCCAT CCGTAAGATG CTTTTCTGTG
      GTGACGTATT AAGAGAATGA CAGTACGGTA GGCATTCTAC GAAAAGACAC

3101  ACTGGTGAGT ACTCAACCAA GTCATTCTGA GAATAGTGTA TGCGGCGACC
      TGACCACTCA TGAGTTGGTT CAGTAAGACT CTTATCACAT ACGCCGCTGG

3151  GAGTTGCTCT TGCCCGGCGT CAATACGGGA TAATACCGCG CCACATAGCA
      CTCAACGAGA ACGGGCCGCA GTTATGCCCT ATTATGGCGC GGTGTATCGT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
                                         XmnI
                                    ~~~~~~~~~~~~
3201  GAACTTTAAA AGTGCTCATC ATTGGAAAAC GTTCTTCGGG GCGAAAACTC
      CTTGAAATTT TCACGAGTAG TAACCTTTTG CAAGAAGCCC CGCTTTTGAG

3251  TCAAGGATCT TACCGCTGTT GAGATCCAGT TCGATGTAAC CCACTCGCGC
      AGTTCCTAGA ATGGCGACAA CTCTAGGTCA AGCTACATTG GGTGAGCGCG

3301  ACCCAACTGA TCCTCAGCAT CTTTTACTTT CACCAGCGTT TCTGGGTGAG
      TGGGTTGACT AGGAGTCGTA GAAAATGAAA GTGGTCGCAA AGACCCACTC

3351  CAAAAACAGG AAGGCAAAAT GCCGCAAAAA AGGGAATAAG GGCGACACGG
      GTTTTTGTCC TTCCGTTTTA CGGCGTTTTT TCCCTTATTC CCGCTGTGCC

3401  AAATGTTGAA TACTCATACT CTTCCTTTTT CAATATTATT GAAGCATTTA
      TTTACAACTT ATGAGTATGA GAAGGAAAAA GTTATAATAA CTTCGTAAAT

                                            BsrGI

3451  TCAGGGTTAT TGTCTCATGA GCGGATACAT ATTTGAAT
      AGTCCCAATA ACAGAGTACT CGCCTATGTA TAAACTTA
```

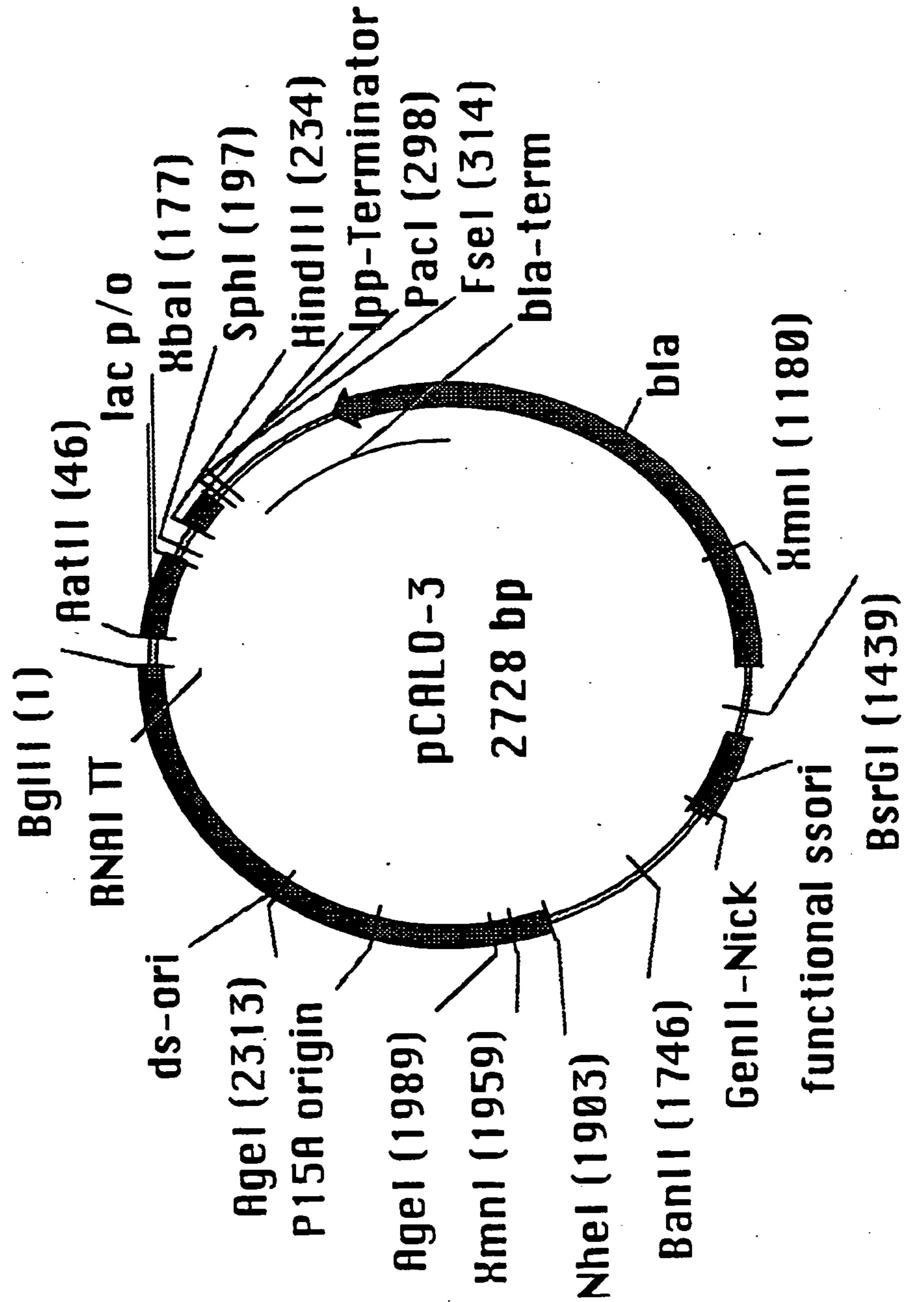



Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

00h2T0" h9006h60

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

pCALO-3:

```
       BglII                                                AatII
       ~~~~~~                                              ~~~~~~~
  1    GATCTCATAA CTTCGTATAA TGTATGCTAT ACGAAGTTAT GACGTCTAAT
       CTAGAGTATT GAAGCATATT ACATACGATA TGCTTCAATA CTGCAGATTA

 51    GTGAGTTAGC TCACTCATTA GGCACCCCAG GCTTTACACT TTATGCTTCC
       CACTCAATCG AGTGAGTAAT CCGTGGGGTC CGAAATGTGA AATACGAAGG

101    GGCTCGTATG TTGTGTGGAA TTGTGAGCGG ATAACAATTT CACACAGGAA
       CCGAGCATAC AACACACCTT AACACTCGCC TATTGTTAAA GTGTGTCCTT

                                  XbaI                SphI
                               ~~~~~~~~              ~~~~~~~
151    ACAGCTATGA CCATGATTAC GAATTTCTAG ACCCCCCCCC CGCATGCCAT
       TGTCGATACT GGTACTAATG CTTAAAGATC TGGGGGGGGG GCGTACGGTA

                                         HindIII
                                         ~~~~~~~
201    AACTTCGTAT AATGTACGCT ATACGAAGTT ATAAGCTTGA CCTGTGAAGT
       TTGAAGCATA TTACATGCGA TATGCTTCAA TATTCGAACT GGACACTTCA

                                                      PacI
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
                                                     ~~~~~~~~~
251  GAAAAATGGC GCAGATTGTG CGACATTTTT TTTGTCTGCC GTTTAATTAA
     CTTTTTACCG CGTCTAACAC GCTGTAAAAA AAACAGACGG CAAATTAATT

             FseI
           ~~~~~~~~~~
301  GGGGGGGGGC CGGCCATTAT CAAAAAGGAT CTCAAGAAGA TCCTTTGATC
     CCCCCCCCCG GCCGGTAATA GTTTTTCCTA GAGTTCTTCT AGGAAACTAG

351  TTTTCTACGG GGTCTGACGC TCAGTGGAAC GAAAACTCAC GTTAAGGGAT
     AAAAGATGCC CCAGACTGCG AGTCACCTTG CTTTTGAGTG CAATTCCCTA

401  TTTGGTCATG AGATTATCAA AAAGGATCTT CACCTAGATC CTTTTAAATT
     AAACCAGTAC TCTAATAGTT TTTCCTAGAA GTGGATCTAG GAAAATTTAA

451  AAAAATGAAG TTTTAAATCA ATCTAAAGTA TATATGAGTA AACTTGGTCT
     TTTTTACTTC AAAATTTAGT TAGATTTCAT ATATACTCAT TTGAACCAGA

501  GACAGTTACC CAATGCTTAA TCAGTGAGGC ACCTATCTCA GCGATCTGTC
     CTGTCAATGG GTTACGAATT AGTCACTCCG TGGATAGAGT CGCTAGACAG

551  TATTTCGTTC ATCCATAGTT GCCTGACTCC CCGTCGTGTA GATAACTACG
     ATAAAGCAAG TAGGTATCAA CGGACTGAGG GGCAGCACAT CTATTGATGC
```

00427014.090060

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
601  ATACGGGAGG GCTTACCATC TGGCCCCAGT GCTGCAATGA TACCGCGAGA
     TATGCCCTCC CGAATGGTAG ACCGGGGTCA CGACGTTACT ATGGCGCTCT

651  CCCACGCTCA CCGGCTCCAG ATTTATCAGC AATAAACCAG CCAGCCGGAA
     GGGTGCGAGT GGCCGAGGTC TAAATAGTCG TTATTTGGTC GGTCGGCCTT

701  GGGCCGAGCG CAGAAGTGGT CCTGCAACTT TATCCGCCTC CATCCAGTCT
     CCCGGCTCGC GTCTTCACCA GGACGTTGAA ATAGGCGGAG GTAGGTCAGA

751  ATTAACTGTT GCCGGGAAGC TAGAGTAAGT AGTTCGCCAG TTAATAGTTT
     TAATTGACAA CGGCCCTTCG ATCTCATTCA TCAAGCGGTC AATTATCAAA

801  GCGCAACGTT GTTGCCATTG CTACAGGCAT CGTGGTGTCA CGCTCGTCGT
     CGCGTTGCAA CAACGGTAAC GATGTCCGTA GCACCACAGT GCGAGCAGCA

851  TTGGTATGGC TTCATTCAGC TCCGGTTCCC AACGATCAAG GCGAGTTACA
     AACCATACCG AAGTAAGTCG AGGCCAAGGG TTGCTAGTTC CGCTCAATGT

901  TGATCCCCCA TGTTGTGCAA AAAAGCGGTT AGCTCCTTCG GTCCTCCGAT
     ACTAGGGGGT ACAACACGTT TTTTCGCCAA TCGAGGAAGC CAGGAGGCTA

951  CGTTGTCAGA AGTAAGTTGG CCGCAGTGTT ATCACTCATG GTTATGGCAG
     GCAACAGTCT TCATTCAACC GGCGTCACAA TAGTGAGTAC CAATACCGTC
```

09006490.021400

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
1001  CACTGCATAA TTCTCTTACT GTCATGCCAT CCGTAAGATG CTTTTCTGTG
      GTGACGTATT AAGAGAATGA CAGTACGGTA GGCATTCTAC GAAAAGACAC

1051  ACTGGTGAGT ACTCAACCAA GTCATTCTGA GAATAGTGTA TGCGGCGACC
      TGACCACTCA TGAGTTGGTT CAGTAAGACT CTTATCACAT ACGCCGCTGG

1101  GAGTTGCTCT TGCCCGGCGT CAATACGGGA TAATACCGCG CCACATAGCA
      CTCAACGAGA ACGGGCCGCA GTTATGCCCT ATTATGGCGC GGTGTATCGT

                                        XmnI
                                    ~~~~~~~~~~~~
1151  GAACTTTAAA AGTGCTCATC ATTGGAAAAC GTTCTTCGGG GCGAAAACTC
      CTTGAAATTT TCACGAGTAG TAACCTTTTG CAAGAAGCCC CGCTTTTGAG

1201  TCAAGGATCT TACCGCTGTT GAGATCCAGT TCGATGTAAC CCACTCGCGC
      AGTTCCTAGA ATGGCGACAA CTCTAGGTCA AGCTACATTG GGTGAGCGCG

1251  ACCCAACTGA TCCTCAGCAT CTTTTACTTT CACCAGCGTT TCTGGGTGAG
      TGGGTTGACT AGGAGTCGTA GAAAATGAAA GTGGTCGCAA AGACCCACTC

1301  CAAAAACAGG AAGGCAAAAT GCCGCAAAAA AGGGAATAAG GGCGACACGG
      GTTTTTGTCC TTCCGTTTTA CGGCGTTTTT TCCCTTATTC CCGCTGTGCC

1351  AAATGTTGAA TACTCATACT CTTCCTTTTT CAATATTATT GAAGCATTTA
```

00h2T0 h9006h60

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
      TTTACAACTT ATGAGTATGA GAAGGAAAAA GTTATAATAA CTTCGTAAAT

                                                 BsrGI
                                                ~~~~~~~~
1401  TCAGGGTTAT TGTCTCATGA GCGGATACAT ATTTGAATGT ACATGAAATT
      AGTCCCAATA ACAGAGTACT CGCCTATGTA TAAACTTACA TGTACTTTAA

1451  GTAAACGTTA ATATTTTGTT AAAATTCGCG TTAAATTTTT GTTAAATCAG
      CATTTGCAAT TATAAAACAA TTTTAAGCGC AATTTAAAAA CAATTTAGTC

1501  CTCATTTTTT AACCAATAGG CCGAAATCGG CAAAATCCCT TATAAATCAA
      GAGTAAAAAA TTGGTTATCC GGCTTTAGCC GTTTTAGGGA ATATTTAGTT

1551  AAGAATAGAC CGAGATAGGG TTGAGTGTTG TTCCAGTTTG GAACAAGAGT
      TTCTTATCTG GCTCTATCCC AACTCACAAC AAGGTCAAAC CTTGTTCTCA

1601  CCACTATTAA AGAACGTGGA CTCCAACGTC AAAGGGCGAA AAACCGTCTA
      GGTGATAATT TCTTGCACCT GAGGTTGCAG TTTCCCGCTT TTTGGCAGAT

1651  TCAGGGCGAT GGCCCACTAC GAGAACCATC ACCCTAATCA AGTTTTTTGG
      AGTCCCGCTA CCGGGTGATG CTCTTGGTAG TGGGATTAGT TCAAAAAACC

                                                    BanII
                                                   ~~~~~~
```

00427O"49006460

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
1701  GGTCGAGGTG CCGTAAAGCA CTAAATCGGA ACCCTAAAGG GAGCCCCCGA
      CCAGCTCCAC GGCATTTCGT GATTTAGCCT TGGGATTTCC CTCGGGGGCT

1751  TTTAGAGCTT GACGGGGAAA GCCGGCGAAC GTGGCGAGAA AGGAAGGGAA
      AAATCTCGAA CTGCCCCTTT CGGCCGCTTG CACCGCTCTT TCCTTCCCTT

1801  GAAAGCGAAA GGAGCGGGCG CTAGGGCGCT GGCAAGTGTA GCGGTCACGC
      CTTTCGCTTT CCTCGCCCGC GATCCCGCGA CCGTTCACAT CGCCAGTGCG

1851  TGCGCGTAAC CACCACACCC GCCGCGCTTA ATGCGCCGCT ACAGGGCGCG
      ACGCGCATTG GTGGTGTGGG CGGCGCGAAT TACGCGGCGA TGTCCCGCGC

       NheI
      ~~~~~~
1901  TGCTAGCGGA GTGTATACTG GCTTACTATG TTGGCACTGA TGAGGGTGTC
      ACGATCGCCT CACATATGAC CGAATGATAC AACCGTGACT ACTCCCACAG

          XmnI                                AgeI
        ~~~~~~~~~~~~                        ~~~~~~~
1951  AGTGAAGTGC TTCATGTGGC AGGAGAAAAA AGGCTGCACC GGTGCGTCAG
      TCACTTCACG AAGTACACCG TCCTCTTTTT TCCGACGTGG CCACGCAGTC

2001  CAGAATATGT GATACAGGAT ATATTCCGCT TCCTCGCTCA CTGACTCGCT
      GTCTTATACA CTATGTCCTA TATAAGGCGA AGGAGCGAGT GACTGAGCGA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
2051  ACGCTCGGTC GTTCGACTGC GGCGAGCGGA AATGGCTTAC GAACGGGGCG
      TGCGAGCCAG CAAGCTGACG CCGCTCGCCT TTACCGAATG CTTGCCCCGC

2101  GAGATTTCCT GGAAGATGCC AGGAAGATAC TTAACAGGGA AGTGAGAGGG
      CTCTAAAGGA CCTTCTACGG TCCTTCTATG AATTGTCCCT TCACTCTCCC

2151  CCGCGGCAAA GCCGTTTTTC CATAGGCTCC GCCCCCCTGA CAAGCATCAC
      GGCGCCGTTT CGGCAAAAAG GTATCCGAGG CGGGGGGACT GTTCGTAGTG

2201  GAAATCTGAC GCTCAAATCA GTGGTGGCGA AACCCGACAG GACTATAAAG
      CTTTAGACTG CGAGTTTAGT CACCACCGCT TTGGGCTGTC CTGATATTTC

2251  ATACCAGGCG TTTCCCCCTG GCGGCTCCCT CCTGCGCTCT CCTGTTCCTG
      TATGGTCCGC AAAGGGGGAC CGCCGAGGGA GGACGCGAGA GGACAAGGAC

                 AgeI
                ~~~~~~
2301  CCTTTCGGTT TACCGGTGTC ATTCCGCTGT TATGGCCGCG TTTGTCTCAT
      GGAAAGCCAA ATGGCCACAG TAAGGCGACA ATACCGGCGC AAACAGAGTA

2351  TCCACGCCTG ACACTCAGTT CCGGGTAGGC AGTTCGCTCC AAGCTGGACT
      AGGTGCGGAC TGTGAGTCAA GGCCCATCCG TCAAGCGAGG TTCGACCTGA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
2401   GTATGCACGA ACCCCCCGTT CAGTCCGACC GCTGCGCCTT ATCCGGTAAC
       CATACGTGCT TGGGGGGCAA GTCAGGCTGG CGACGCGGAA TAGGCCATTG

2451   TATCGTCTTG AGTCCAACCC GGAAAGACAT GCAAAAGCAC CACTGGCAGC
       ATAGCAGAAC TCAGGTTGGG CCTTTCTGTA CGTTTTCGTG GTGACCGTCG

2501   AGCCACTGGT AATTGATTTA GAGGAGTTAG TCTTGAAGTC ATGCGCCGGT
       TCGGTGACCA TTAACTAAAT CTCCTCAATC AGAACTTCAG TACGCGGCCA

2551   TAAGGCTAAA CTGAAAGGAC AAGTTTTAGT GACTGCGCTC CTCCAAGCCA
       ATTCCGATTT GACTTTCCTG TTCAAAATCA CTGACGCGAG GAGGTTCGGT

2601   GTTACCTCGG TTCAAAGAGT TGGTAGCTCA GAGAACCTAC GAAAAACCGC
       CAATGGAGCC AAGTTTCTCA ACCATCGAGT CTCTTGGATG CTTTTTGGCG

2651   CCTGCAAGGC GGTTTTTTCG TTTTCAGAGC AAGAGATTAC GCGCAGACCA
       GGACGTTCCG CCAAAAAAGC AAAAGTCTCG TTCTCTAATG CGCGTCTGGT

                                 BglII

2701   AAACGATCTC AAGAAGATCA TCTTATTA
       TTTGCTAGAG TTCTTCTAGT AGAATAAT
```

Figure 35b: List of oligonucleotides used for synthesis of modules

M1: PCR using template

NoVspAatII: TAGACGTC

M2: synthesis

BloxA-A: TATGAGATCTCATAACTTCGTATAATGTACGCTATACG-AAGTTAT

BloxA-B: TAATAACTTCGTATAGCATACATTATACGAAGTTATG-AGATCTCA

M3: PCR, NoVspAatII as second oligo

XloxS-muta: CATTTTTTGCCCTCGTTATCTACGCATGCGATAACTTCGTA-TAGCGTACATTATACGAAGTTATTCTAGACATGGTCATAGCTGTTTCCTG

M7-I: PCR

gIIINEW-fow: GGGGGGAATTCGGTGGTGGTGGATCTGCGTGCGCTG-AAACGGTTGAAAGTTG

gIIINEW-rev: CCCCCCCAAGCTTATCAAGACTCCTTATTACG

M7-II: PCR

gIIIss-fow: GGGGGGGGAATTCGGAGGCGGTTCCGGTGGTGGC

M7-III: PCR

gIIIsupernew-fow: GGGGGGGGAATTCGAGCAGAAGCTGATCTCT-GAGGAGGATCTGTAGGGTGGTGGCTCTGGTTCCGGTGATTTTG

Figure 35b: List of oligonucleotides used for synthesis of modules (continued)

M8: synthesis

lox514-A: CCATAACTTCGTATAATGTACGCTATACGAAGTTATA

lox514-B: AGCTTATAACTTCGTATAGCGTACATTATACGAAGT-TATGGCATG

M9II: synthesis

M9II-fow: AGCTTGACCTGTGAAGTGAAAAATGGCGCAGATT-GTGCGACATTTTTTTTGTCTGCCGTTTAATTAAAGGGGGGGT

M9II-rev: GTACACCCCCCCCAGGCCGGCCCCCCCCCCCTTTAA-TTAAACGGCAGACAAAAAAAATGTCGCACAATCTGCG

M10II: assembly PCR with template

bla-fow: GGGGGGGTGTACATTCAAATATGTATCCGCTCATG

bla-seq4: GGGTTACATCGAACTGGATCTC

bla1-muta: CCAGTTCGATGTAACCCACTCGCGCACCCAACTGATC-CTCAGCATCTTTTACTTTCACC

blaII-muta: ACTCTAGCTTCCCGGCAACAGTTAATAGACTGGATG-GAGGCGG

bla-NEW: CTGTTGCCGGGAAGCTAGAGTAAG

bla-rev: CCCCCCCTTAATTAAGGGGGGGGGCCGGCCATTATCAAA-AAGGATCTCAAGAAGATCC

M11II/III: PCR, site-directed mutagenesis

Figure 35b: List of oligonucleotides used for synthesis of modules (continued)

f1-fow: GGGGGGGCTAGCACGCGCCCTGTAGCGGCGCATTAA

f1-rev: CCCCCCCTGTACATGAAATTGTAAACGTTAATATTTTG

f1-t133.muta: GGGCGATGGCCCACTACGAGAACCATCACCCTAATC

M12: assembly PCR using template

p15-fow: GGGGGAGATCTAATAAGATGATCTTCTTGAG

p15-NEWI: GAGTTGGTAGCTCAGAGAACCTACGAAAAACCGCCCTG-CAAGGCG

p15-NEWII: GTAGGTTCTCTGAGCTACCAACTC

p15-NEWIII: GTTTCCCCCTGGCGGCTCCCTCCTGCGCTCTCCTGTTCCT-GCC

p15-NEWIV: AGGAGGGAGCCGCCAGGGGGAAAC

p15-rev: GACATCAGCGCTAGCGGAGTGTATAC

M13: synthesis

BloxXB-A: GATCTCATAACTTCGTATAATGTATGCTATACGAAGTTA-TTCA

BloxXB-B: GATCTGAATAACTTCGTATAGCATACATTATACGAAGTTA-TGAGA

M14-Ext2: PCR, site-directed mutagenesis

ColEXT2-fow: GGGGGGGAGATCTGACCAAAATCCCTTAACGTGAG

Col-mutal: GGTATCTGCGCTCTGCTGTAGCCAGTTACCTTCGG

Figure 35b: List of oligonucleotides used for synthesis of modules (continued)

Col-rev: CCCCCCCGCTAGCCATGTGAGCAAAAGGCCAGCAA

M17: assembly PCR using template

CAT-1: GGGACGTCGGGTGAGGTTCCAAC

CAT-2: CCATACGGAACTCCGGGTGAGCATTCATC

CAT-3: CCGGAGTTCCGTATGG

CAT-4: ACGTTTAAATCAAAACTGG

CAT-5: CCAGTTTTGATTTAAACGTAGCCAATATGGACAACTTCTTC-GCCCCCGTTTTCACTATGGGCAAATATT

CAT-6: GGAAGATCTAGCACCAGGCGTTTAAG

M41: assembly PCR using template

LAC1: GAGGCCGGCCATCGAATGGCGCAAAAC

LAC2: CGCGTACCGTCCTCATGGGAGAAAATAATAC

LAC3: CCATGAGGACGGTACGCGACTGGGCGTGGAGCATCTGGTCGCA-TTGGGTCACCAGCAAATCCGCTGTTAGCTGGCCCATTAAG

LAC4: GTCAGCGGCGGGATATAACATGAGCTGTCCTCGGTATCGTCG

LAC5: GTTATATCCCGCCGCTGACCACCATCAAAC

LAC6: CATCAGTGAATCGGCCAACGCGCGGGGAGAGGCGGTTTGCGT4TTG-GGAGCCAGGGTGGTTTTTC

LAC7: GGTTAATTAACCTCACTGCCCGCTTTCCAGTCGGGAAACCTGTCGTGCC-AGCTGCATCAGTGAATCGGCCAAC

M41-MCS-fow: CTAGACTAGTGTTTAAACCGGACCGGGGGGGGGCTT-AAGGGGGGGGGGGG

Figure 35b: List of oligonucleotides used for synthesis of modules (continued)

M41-MCS-rev: CTAGCCCCCCCCCCCTTAAGCCCCCCCCCGGTCCGGT-TTAAACACTAGT

M41-fow: CTAGACTAGTGTTTAAACCGGACCGGGGGGGGGCTTAA-GGGGGGGGGGG

M41-rev: CCCCCCCTTAAGTGGGCTGCAAAACAAAACGGCCTCC-TGTCAGGAAGCCGCTTTTATCGGGTAGCCTCACTGCCCGCTTTCC

M41-A2: GTTGTTGTGCCACGCGGTTAGGAATGTAATTCAGCTCCGC

M41-B1: AACCGCGTGGCACAACAAC

M41-B2: CTTCGTTCTACCATCGACACGACCACGCTGGCACCCAGTTG

M41-C1: GTGTCGATGGTAGAACGAAG

M41-CII: CCACAGCAATAGCATCCTGGTCATCCAGCGGATAGTT-AATAATCAGCCCACTGACACGTTGCGCGAG

M41-DI: GACCAGGATGCTATTGCTGTGG

M41-DII: CAGCGCGATTTGCTGGTGGCCCAATGCGACCAGATGC

M41-EI: CACCAGCAAATCGCGCTG

M41-EII: CCCGGACTCGGTAATGGCACGCATTGCGCCCAGCGCC

M41-FI: GCCATTACCGAGTCCGGG

<u>M42: synthesis</u>

Eco-H5-Hind-fow: AATTCCACCATCATCACCATTGACGTCTA

Eco-H5-Hind-rev: AGCTTAGACGTCAATGGTGATGATGGTGG

Figure 36: functional map and sequence of ß-lactamase-MCS module

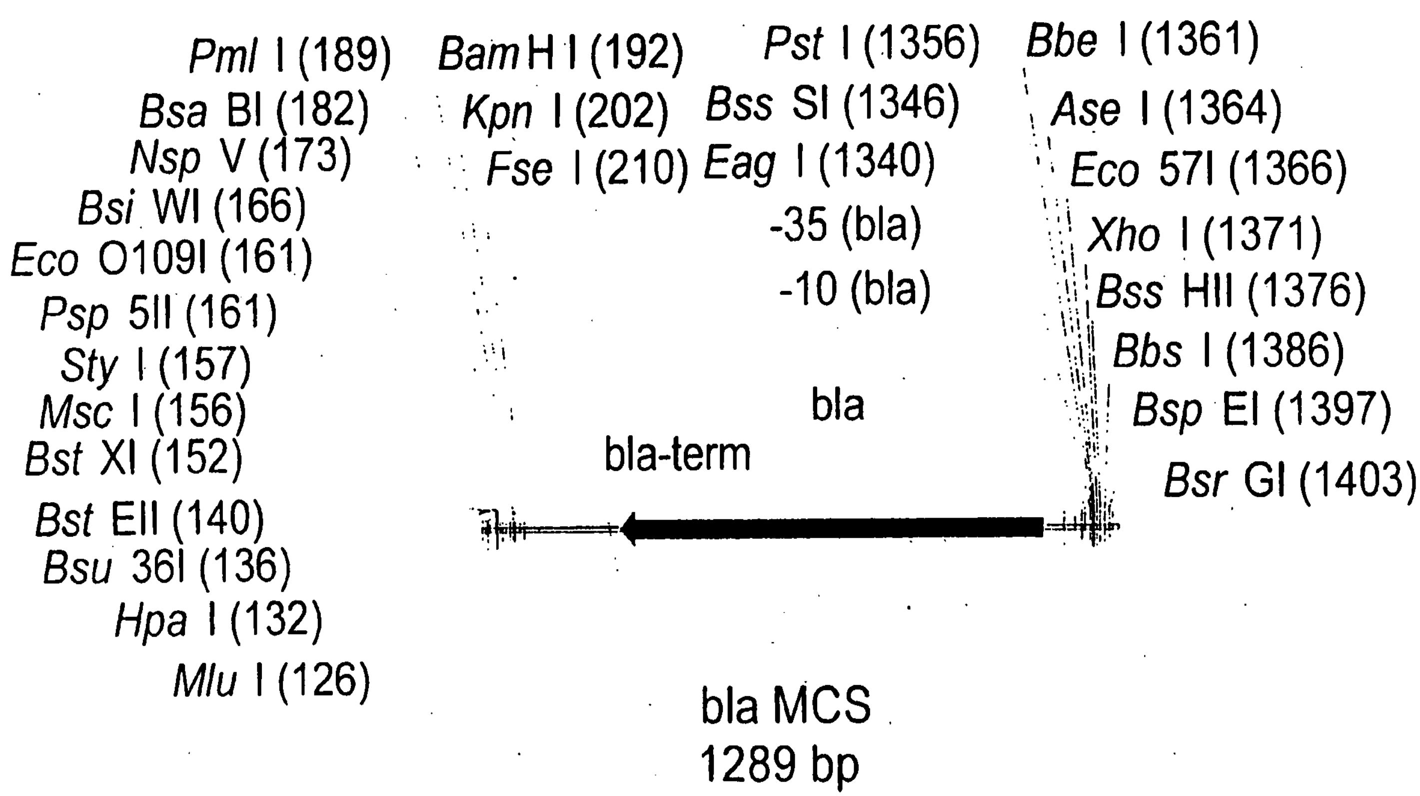


Figure 36: functional map and sequence of ß-lactamase-MCS module (continued)

```
                                                  StyI
                                                 ~~~~~~~
                                                    Psp5II
                                                   ~~~~~~~~
        MluI     Bsu36I            BstXI          EcoO109I
        ~~~~~~   ~~~~~~~~~    ~~~~~~~~~~~~~~      ~~~~~~~~
            HpaI        BstEII             MscI             BsiWI NspV
           ~~~~~~~      ~~~~~~~~          ~~~~~~~~        ~~~~~~~~~~~~~
126     CGCGTTAACC TCAGGTGACC AAGCCCCTGG CCAAGGTCCC GTACGTTCGA
        GCGCAATTGG AGTCCACTGG TTCGGGGACC GGTTCCAGGG CATGCAAGCT

                   PmlI
                  ~~~~~~~
        NspVBsaBI        BamHI  KpnI       FseI
        ~~~~~~~~~~~~~   ~~~~~~~~~~~~~~~  ~~~~~~~~~~
176     AGATTACCAT CACGTGGATC CGGTACCAGG CCGGCCATTA TCAAAAAGGA
        TCTAATGGTA GTGCACCTAG GCCATGGTCC GGCCGGTAAT AGTTTTTCCT

226     TCTCAAGAAG ATCCTTTGAT CTTTTCTACG GGGTCTGACG CTCAGTGGAA
        AGAGTTCTTC TAGGAAACTA GAAAAGATGC CCCAGACTGC GAGTCACCTT

276     CGAAAACTCA CGTTAAGGGA TTTTGGTCAT GAGATTATCA AAAAGGATCT
        GCTTTTGAGT GCAATTCCCT AAAACCAGTA CTCTAATAGT TTTTCCTAGA
```

Figure 36: functional map and sequence of ß-lactamase-MCS module (continued)

```
326   TCACCTAGAT CCTTTTAAAT TAAAAATGAA GTTTTAAATC AATCTAAAGT
      AGTGGATCTA GGAAAATTTA ATTTTTACTT CAAAATTTAG TTAGATTTCA

376   ATATATGAGT AAACTTGGTC TGACAGTTAC CAATGCTTAA TCAGTGAGGC
      TATATACTCA TTTGAACCAG ACTGTCAATG GTTACGAATT AGTCACTCCG

426   ACCTATCTCA GCGATCTGTC TATTTCGTTC ATCCATAGTT GCCTGACTCC
      TGGATAGAGT CGCTAGACAG ATAAAGCAAG TAGGTATCAA CGGACTGAGG

476   CCGTCGTGTA GATAACTACG ATACGGGAGG GCTTACCATC TGGCCCCAGT
      GGCAGCACAT CTATTGATGC TATGCCCTCC CGAATGGTAG ACCGGGGTCA

526   GCTGCAATGA TACCGCGAGA CCCACGCTCA CCGGCTCCAG ATTTATCAGC
      CGACGTTACT ATGGCGCTCT GGGTGCGAGT GGCCGAGGTC TAAATAGTCG

576   AATAAACCAG CCAGCCGGAA GGGCCGAGCG CAGAAGTGGT CCTGCAACTT
      TTATTTGGTC GGTCGGCCTT CCCGGCTCGC GTCTTCACCA GGACGTTGAA

626   TATCCGCCTC CATCCAGTCT ATTAACTGTT GCCGGGAAGC TAGAGTAAGT
      ATAGGCGGAG GTAGGTCAGA TAATTGACAA CGGCCCTTCG ATCTCATTCA

676   AGTTCGCCAG TTAATAGTTT GCGCAACGTT GTTGCCATTG CTACAGGCAT
      TCAAGCGGTC AATTATCAAA CGCGTTGCAA CAACGGTAAC GATGTCCGTA
```

Figure 36: functional map and sequence of ß-lactamase-MCS module (continued)

```
726   CGTGGTGTCA CGCTCGTCGT TTGGTATGGC TTCATTCAGC TCCGGTTCCC
      GCACCACAGT GCGAGCAGCA AACCATACCG AAGTAAGTCG AGGCCAAGGG

776   AACGATCAAG GCGAGTTACA TGATCCCCCA TGTTGTGCAA AAAAGCGGTT
      TTGCTAGTTC CGCTCAATGT ACTAGGGGGT ACAACACGTT TTTTCGCCAA

826   AGCTCCTTCG GTCCTCCGAT CGTTGTCAGA AGTAAGTTGG CCGCAGTGTT
      TCGAGGAAGC CAGGAGGCTA GCAACAGTCT TCATTCAACC GGCGTCACAA

876   ATCACTCATG GTTATGGCAG CACTGCATAA TTCTCTTACT GTCATGCCAT
      TAGTGAGTAC CAATACCGTC GTGACGTATT AAGAGAATGA CAGTACGGTA

926   CCGTAAGATG CTTTTCTGTG ACTGGTGAGT ACTCAACCAA GTCATTCTGA
      GGCATTCTAC GAAAAGACAC TGACCACTCA TGAGTTGGTT CAGTAAGACT

976   GAATAGTGTA TGCGGCGACC GAGTTGCTCT TGCCCGGCGT CAATACGGGA
      CTTATCACAT ACGCCGCTGG CTCAACGAGA ACGGGCCGCA GTTATGCCCT

1026  TAATACCGCG CCACATAGCA GAACTTTAAA AGTGCTCATC ATTGGAAAAC
      ATTATGGCGC GGTGTATCGT CTTGAAATTT TCACGAGTAG TAACCTTTTG

1076  GTTCTTCGGG GCGAAAACTC TCAAGGATCT TACCGCTGTT GAGATCCAGT
      CAAGAAGCCC CGCTTTTGAG AGTTCCTAGA ATGGCGACAA CTCTAGGTCA
```

Figure 36: functional map and sequence of β-lactamase-MCS module (continued)

```
1126  TCGATGTAAC CCACTCGTGC ACCCAACTGA TCTTCAGCAT CTTTTACTTT
      AGCTACATTG GGTGAGCACG TGGGTTGACT AGAAGTCGTA GAAAATGAAA
                  BssSI                Eco57I
                 ~~~~~~~              ~~~~~~~

1176  CACCAGCGTT TCTGGGTGAG CAAAAACAGG AAGGCAAAAT GCCGCAAAAA
      GTGGTCGCAA AGACCCACTC GTTTTTGTCC TTCCGTTTTA CGGCGTTTTT

1226  AGGGAATAAG GGCGACACGG AAATGTTGAA TACTCATACT CTTCCTTTTT
      TCCCTTATTC CCGCTGTGCC TTTACAACTT ATGAGTATGA GAAGGAAAAA

1276  CAATATTATT GAAGCATTTA TCAGGGTTAT TGTCTCATGA GCGGATACAT
      GTTATAATAA CTTCGTAAAT AGTCCCAATA ACAGAGTACT CGCCTATGTA

                                 PstI                XhoI
                               ~~~~~~~~             ~~~~~~~
                  EagI    BssSI          BbeI  AseI    BssHII
                 ~~~~~~~~~~~~~~          ~~~~~~~~~~~~~~     ~
1326  ATTTGAATGT ACTCGGCCGC ACGAGCTGCA GGCGCCATTA ATGGCTCGAG
      TAAACTTACA TGAGCCGGCG TGCTCGACGT CCGCGGTAAT TACCGAGCTC

      BssHII                BspEI BsrGI
      ~~~~~                ~~~~~~~~~~~~~~
```

Figure 36: functional map and sequence of ß-lactamase-MCS module (continued)

```
1376   CGCGCTTCAG CGCTTTGTCT TCCGGATGTA CATGAAATT
       GCGCGAAGTC GCGAAACAGA AGGCCTACAT GTACTTTAA
           Eco57I         BbsI
           ~~~~~~~       ~~~~~~~~
```

Figure 37: Oligo and primer design for Vκ CDR3 libraries

| | | 1 | | | | | | | | | 10 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| O_K3L_5 | 5'- | G | C | C | C | T | G | C | A | A | G | C | G | G | A | A | G | A | C |
| | | | | | | | | | | | | | | BbsI | | | | | |
| | | | | | | | | | | | | | | | E | | | D | |
| Vk1 & Vk3 | 5'- | G | C | C | C | T | G | C | A | A | G | C | G | G | A | A | G | A | C |
| | | | | | | | | | | | | | | | E | | | D | |
| Vk2 | 5'- | G | C | C | C | T | G | C | A | A | G | C | G | G | A | A | G | A | C |
| | | | | | | | | | | | | | | | E | | | D | |
| Vk4 | 5'- | G | C | C | C | T | G | C | A | A | G | C | G | G | A | A | G | A | C |

Figure 37: Oligo and primer design for Vκ CDR3 libraries

20 30 40

-3'

```
     F        A      T/V       Y        Y      C                 Q
T    T  T  G  C  G  A  C  T  T  A  T  T  A  T  T  G  C          C A
                    G  T  T

     V        G        V       Y        Y      C
G    T  G  G  G  C  G  T  G  T  A  T  T  A  T  T  G  C          C A
     V        A        V       Y        Y      C
G    T  G  G  C  G  G  T  G  T  A  T  T  A  T  T  G  C          C A
```

| | |
|---|---|
| A | |
| C | |
| D | |
| E | |
| F | T T T |
| G | |
| H | C A T |
| I | |
| K | |
| L | C T T |
| M | A T G |
| N | |
| P | |
| Q | C A G |
| R | |
| S | |
| T | |
| V | |
| W | |
| Y | |
| | 80% Q |

Figure 37: Oligo and primer design for Vκ CDR3 libraries

50 60

3'- G G A

T

G A C C T

T

G A C C T

T

G A C C T

| | | | | | |
|---|---|---|---|---|---|
| G C T | | | G C T | | G C T |
| | | | | | |
| G A T | G A T | G A T | G A T | | G A T |
| G A G | | | G A G | | G A G |
| T T T | | | T T T | | T T T |
| G G T | G G T | G G T | G G T | | G G T |
| C A T | | | C A T | | C A T |
| A . T | | | A T T | | A T T |
| A A G | | | A A G | | A A G |
| C T T | | | C T T | | C T T |
| A T G | | | A T G | | A T G |
| A A T | A A T | A A T | A A T | | A A T |
| | | | C C T | C C T | C C T |
| C A G | | | C A G | | C A G |
| C G T | | | C G T | | C G T |
| T C T | T C T | T C T | T C T | T C T | T C T |
| A C T | | | A C T | | A C T |
| G T T | | | G T T | | G T T |
| T G G | | | T G G | | T G G |
| T A T | T A T | | T A T | | T A T |
| 50% Y | | | | 80% P | |

Figure 37: Oligo and primer design for Vκ CDR3 libraries

```
            70                          80  81
A A C C G G T A A G C T T T C G G  -5' O_K3L_3
  [  MscI   ]
F     G     Q
T [T G G C C A] T T C G A A A G C C  -3'

F     G     Q
T [T G G C C A] T T C G A A A G C C  -3'
F     G     Q
T [T G G C C A] T T C G A A A G C C  -3'
```

Figure 38: Oligo and primer design for Vλ CDR3 libraries

```
     1                  10                  20
                          E     D     E     A     D
5'- C C T G C A A G C G [G A A G A C] G A A G C G G A T T -
```

Figure 38: Oligo and primer design for Vλ CDR3 libraries

30 40 50

Y Y C Q S D

-ATTATTGCCAGAGC GAC

| | | | | |
|---|---|---|---|---|
| A | | | GCT | GCT - |
| C | | | | |
| D | | | GAT | GAT |
| E | | | GAG | GAG |
| F | | | TTT | TTT |
| G | | | GGT | GGT |
| H | | | CAT | CAT |
| I | | | ATT | ATT |
| K | | | AAG | AAG |
| L | | | CTT | CTT |
| M | | | ATG | ATG |
| N | | | AAT | AAT |
| P | | | CCT | CCT |
| Q | | | CAG | CAG |
| R | CGT | | CGT | CGT |
| S | | | TCT | TCT |
| T | | | ACT | ACT |
| V | | | GTT | GTT |
| W | TGG | | | |
| Y | TAT | | TAT | TAT |
| | 3 | 1 | 18 | 18 |
| | 3 | 1 | 18 | 18 |
| | 3 | 1 | 18 | 18 |

Figure 38: Oligo and primer design for Vλ CDR3 libraries

60 70 80

G G G T K L

GGCGGCGGCACGAAGTTA

| | | gap | gap | | |
|---|---|---|---|---|---|
| - | G C T | G C T | G C T | G C T | |
| | G A T | G A T | G A T | G A T | |
| | G A G | G A G | G A G | G A G | |
| | T T T | T T T | T T T | T T T | |
| | G G T | G G T | G G T | G G T | |
| | C A T | C A T | C A T | C A T | |
| | A T T | A T T | A T T | A T T | |
| | A A G | A A G | A A G | A A G | |
| | C T T | C T T | C T T | C T T | |
| | A T G | A T G | A T G | A T G | |
| | A A T | A A T | A A T | A A T | |
| | C C T | C C T | C C T | C C T | |
| | C A G | C A G | C A G | C A G | |
| | C G T | C G T | C G T | C G T | |
| | T C T | T C T | T C T | T C T | |
| | A C T | A C T | A C T | A C T | |
| | G T T | G T T | G T T | G T T | |
| | | | | T G G | |
| | T A T | T A T | T A T | T A T | Variability |
| | 18 | | | 19 | 3.32E+05 |
| | 18 | 18 | | 19 | 5.98E+06 |
| | 18 | 18 | 18 | 19 | 1.08E+08 |

Figure 38: Oligo and primer design for Vλ CDR3 libraries

```
                    90                 100             108
 T     V     L     G     Q     E     F
ACCGTTCTTGGCCAGGAATTCGAGCC-3'
               3'-CCGGTCCTTAAGCTCGG-5'
```

(Boxed: GAATTC)

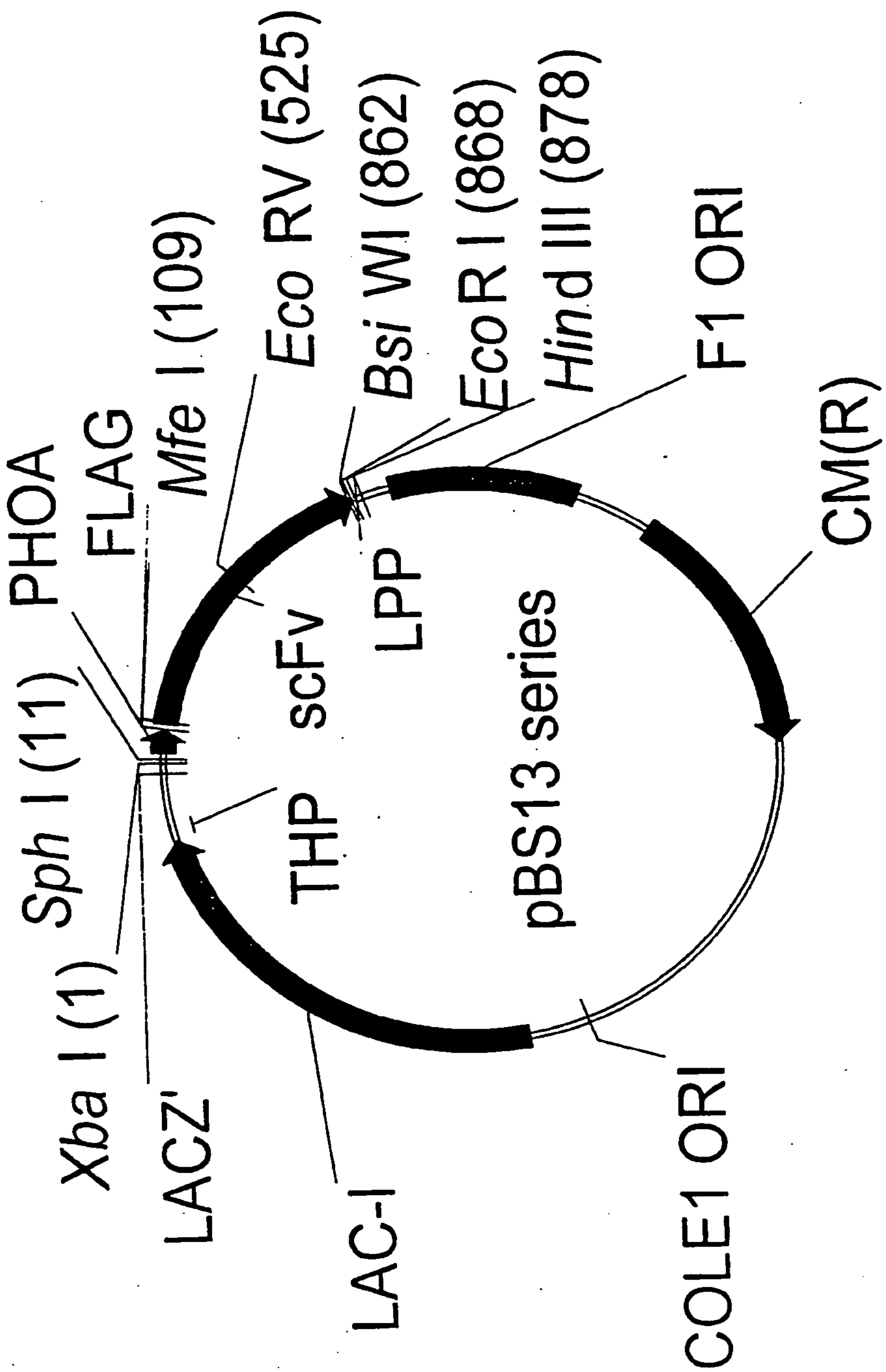



Figure 39: functional map of expression vector series pBS13

Figure 40: Expression data for HuCAL scFvs (pBS13, 30°C)

| % soluble | κ1 | κ2 | κ3 | κ4 | λ1 | λ2 | λ3 |
|---|---|---|---|---|---|---|---|
| H1A | 61% | 58% | 52% | 42% | 90% | 61% | 60% |
| H1B | 39% | 48% | 66% | 48% | 47% | 39% | 36% |
| H2 | 47% | 57% | 46% | 49% | 37% | 36% | 45% |
| H3 | 85% | 67% | 76% | 61% | 80% | 71% | 83% |
| H4 | 69% | 52% | 51% | 44% | 45% | 33% | 42% |
| H5 | 49% | 49% | 46% | 67% | 54% | 46% | 47% |
| H6 | 90% | 58% | 54% | 47% | 45% | 50% | 51% |

| Total amount compared to H3κ2 | κ1 | κ2 | κ3 | κ4 | λ1 | λ2 | λ3 |
|---|---|---|---|---|---|---|---|
| H1A | 289% | 94% | 166% | 272% | 20% | 150% | 78% |
| H1B | 219% | 122% | 89% | 139% | 117% | 158% | 101% |
| H2 | 186% | 223% | 208% | 182% | 126% | 60% | 97% |
| H3 | 50% | | 71% | 54% | 59% | 130% | 47% |
| H4 | 37% | 55% | 60% | 77% | 195% | 107% | 251% |
| H5 | 98% | 201% | 167% | 83% | 93% | 128% | 115% |
| H6 | 65% | 117% | 89% | 109% | 299% | 215% | 278% |

Figure 40: Expression data for HuCAL scFvs (pBS13, 30°C)

| Soluble amount compared to H3κ2 | κ1 | κ2 | κ3 | κ4 | λ1 | λ2 | λ3 |
|---|---|---|---|---|---|---|---|
| H1A | 191% | 88% | 121% | 122% | 26% | 211% | 76% |
| H1B | 124% | 95% | 83% | 107% | 79% | 142% | 59% |
| H2 | 126% | 204% | 139% | 130% | 66% | 50% | 70% |
| H3 | 63% | - | 81% | 49% | 69% | 143% | 61% |
| H4 | 40% | 47% | 49% | 54% | 95% | 55% | 125% |
| H5 | 69% | 158% | 116% | 80% | 72% | 84% | 84% |
| H6 | 85% | 122% | 87% | 77% | 162% | 162% | 212% |

| | McPC |
|---|---|
| soluble | 38% |
| %H3k2 total | 117% |
| %H3k2 soluble | 69% |